VETERINARY MEDICINE

AUG 25 1954
FORESTRY LIBRARY

features in this issue...

Practical Endocrinological Considerations

Antirabic Immunization of Cattle

Reproductive Ability After Recovery from Bovine Hyperkeratosis

Stability of Hog Cholera Virus

Furazolidone in Treatment of Fowl Typhoid

Effect of Chorophyll Derivatives on Mating Odors of Dogs

X-Ray Machines and Related Physics

The Distemper

(Complete Index on Page VIII)

ESTABLISHED 1905

PUBLISHED MONTHLY

Entered as second-class matter September 15, 1949, at the post office at Kansas City, Mo., under the Act of March 3, 1879.

$5.00 PER YEAR
50c PER COPY

SUITE 803 LIVESTOCK EXCHANGE BUILDING, KANSAS CITY 2, MISSOURI, U.S.A.

TRI-INSTILIN (Jen-Sal) clears up mastitis infections when other products fail

The basic clinical testing that resulted in the TRI-INSTILIN formula was conducted largely on cases where *other mastitis formulas had FAILED!*

Infected quarters selected for experimental therapy had previously been treated with various antibiotic-sulfonamide combinations *without response.* TRI-INSTILIN was instilled into each quarter—*and by the fourth day, no staphylococci or streptococci could be cultured!* Milk samples remained negative.

TRI-INSTILIN's efficiency lies in two important points of formulation: 1) an exclusive free-flowing oil base that carries medication upward, throughout the infected quarter; 2) the most effective synergistic antibiotic combination yet developed for mastitis.

Each 7.5 cc. tube of TRI-INSTILIN contains 500,0 units of procaine penicillin G, plus 50 mg. NE MYCIN and 2500 units BACITRACIN! TRI-INSTI is a professional formula—packaged in a cle modern, professional-looking carton.

TRI-INSTILIN is available in dispensing cartons six 7.5 cc. tubes each, 100 cc. vials and ster single-dose, plastic syringes. Order from y Jen-Sal branch or distributor.

Jensen-Salsbery Laboratories, Inc.
Kansas City 41, Missouri

VM NEWS COMMENT

Keep Selling Brucellosis Eradication

Reports from widely separated parts of the country suggest that the interest of livestockmen in brucellosis eradication is great. Veterinarians in most states have assumed leadership in campaigns. It is vital to success that 100% of growers participate and that veterinarians keep testing animals and selling the program. Concurrently, every effort should, and must, be made to improve the technic for diagnosis of the infected spreader animal.

Milk Fever—Prevention by Diets

Dairymen have been quick in trying the suggestion of California investigators that milk fever may be prevented by supplying a low calcium—high phosphorus ration. Report of research work (see VETERINARY MEDICINE, 49:125 [Mar.], 1954) indicates that parathyroid stimulation for 30 days prior to parturition, by supplying high phosphorus diets, may reduce incidence of this metabolic disturbance. County agents are recommending that dairymen experiment with the plan. Favorable reports are being passed among farmers and dairymen.

Veterinarians are urged to acquaint themselves with suggestions of these researchers and be on the lookout for progress reports.

Social Security for Veterinarians

In spite of recommendation of the A.V.M.A. to both the House and Senate Committees, veterinarians probably will be included under provisions of the Social Security Act (OASI). It is understood that the proposed bill calls for a tax of 3% on the first $4,200. of annual earnings of self-employed veterinarians. Tax rate is scheduled to increase to 7% by 1960, possibly on an even greater minimum of earnings.

Physicians have been excluded again from requirements of the Act by the House Ways and Means Committee which reversed previous action.

Vesicular Exanthema Outbreak in Iowa

On July 26 an alert inspector discovered a few infected swine in the stockyards at Ottumwa, Iowa, later confirmed as vesicular exanthema. A total of 6,000 animals were condemned, slaughtered, and processed. Dr. H. U. Garrett reports that premises have been cleaned and no infection has been found to date on checking source herds.

UNIVERSITY OF MICHIGAN LIBRARIES

VETERINARY MEDICINE

A Monthly Magazine Devoted to the Promotion of the Art and Science of Veterinary Medicine

Vol. XLIX SEPTEMBER 1954 No. 9

Published Monthly by the

VETERINARY MAGAZINE CORPORATION

Suite 803, Livestock Exchange Building
Kansas City 2, Missouri, U.S.A.
Telephone: Victor 2985

EDITOR

ROBERT L. ANDERES, B.S., D.V.M.

DEPARTMENT EDITORS

R. R. DYKSTRA, D.V.M.,
Manhattan, Kansas

A. O. FOSTER, B.A., M.A., Sc.D.
Beltsville, Maryland

W. R. HINSHAW, D.V.M., Ph.D.
Frederick, Maryland

JAMES H. STEELE, D.V.M., M.P.H.
Atlanta, Georgia

REPRESENTATIVE

H. J. Mostyn, P. O. Box 391, Dover, N. J.

SUBSCRIPTION RATES. One year, $5.00; two years, $8.75; three years, $12.00. Single copy, 50c. U S. Funds. Postage prepaid. Authorized agents will present letter of collection authority. Pay no money to others.

Entered as second class matter at the post office at Kansas City, Missouri. Entered as second class matter under the title of the American Journal of Veterinary Medicine, July 19, 1910, at Chicago, Illinois, under the Act of March 3, 1879.

All matter appearing in this publication is copyrighted. No part of it may be reproduced without written permission. Permission will be given if the purpose is unobjectionable. If there be any question as to the propriety of reproduction the author will be consulted.

CHANGE OF ADDRESS: Prompt notice of change of address is requested to assure accurate mailing, giving old and new address. Address all communications to Veterinary Medicine, Suite 803, Livestock Exchange Bldg., Kansas City 2, Missouri.

AUTHOR-CONTRIBUTORS: Articles submitted for publication are accepted as original communications and with the understanding that they are not submitted to other journals. Manuscripts should be clearly typed, double spaced with wide margins, and sheets numbered consecutively. See prior issues for style. Tables and charts should be simple and clearly illustrate the text material.

Copyright, 1954, by the Veterinary Magazine Corporation, Kansas City 2, Missouri

In This Issue . . .

General Practice . . .

Some Practical Endocrinological Considerations—H. J. Hill 361
Antirabic Immunization of Cattle in Georgia Using Living Virus Vaccine of Chick Embryo Origin—L. E. Starr, T. B. Clower, C. L. Bromley, Jr., and C. F. Routh 366
Further Observations on Reproductive Ability After Recovery from Bovine Hyperkeratosis—C. Olson, Jr., and L. V. Skidmore. 371
Stability of Hog Cholera Virus—L. H. Schwarte and John Mathews 375
Clinical Investigation of Furazolidone in the Treatment of Fowl Typhoid—A. S. Cosgrove 393

Small Animal Practice . . .

Effect of Chlorophyll Derivatives on Mating Odors of Dogs—H. T. Gier 377
X-ray Machines and Related Physics—L. G. Idstrom 381
The Distemper—Delabere P. Blaine 386

Editorial Comments . . .

VM News Comment VII
Stabilized Medical Fees 365
Bluetongue Vaccine Available 365
Anthrax Outbreak in Seattle Zoo 388
Veterinary Fees for Rabies Vaccination 392
Household Steel Kitchen Cabinet Assemblies Serve Small Animal Surgery Needs 392
Veterinarians Needed as Poultry Inspectors 394
Exhibit Purebred Swine from Quarantined Area 394
Staggering Losses Due to Livestock Diseases ... 395
Question Box 395
First Lieutenant Bill Signed by the President 396
M Vaccine Fails in Wisconsin Test 396
Brief History of Ornithosis "Psittacosis" With Particular Reference to Outbreaks in Poultry Plant Employees 397
Rations and Meat Quality 397
Stiffen California Regulations Pertaining to Vesicular Exanthema 397
Blood-Free Heart Surgery 397
Less Than 1% Brucella Reactors in Oregon 402
A Mobile Garbarge Cooker XXVII
From the Agricultural Press XXVIII
Marketing Veterinary Products XXXV
Dr. William Moore, 1884-1954 XXXVI
Rabies Vaccine for Cattle XXXVI
Equine Encephalomyelitis XXXIX
Principles of Animal Health—R. R. Dykstra 398
Poultry Practice Problems—W. R. Hinshaw 399
Public Health—James H. Steele 400

Clinical Reports . . .

Emetics in Small Animal Practice—L. F. Whitney and G. D. Whitney 389
Intestinal Trichomoniasis in a Dog—Frank A. O'Donnell 390
Luxation of the Patella—James E. Carver 401
Mercury Poisoning in a Dairy Herd—W. H. Herberg 401
Book Reviews 403
Items of Veterinary Interest 404
Meeting Calendar XL
Necrology XLIII

Some Practical Endocrinological Considerations

H. J. HILL,* D.V.M., Ft. Collins, Colorado

The author states in this article, that the purpose of endocrine therapy is to restore physiological balance among all the endogenous hormones related to the system out of normal function, not for their stimulatory effect.

Any discussion of the clinical use of endocrines is likely to be disappointing because of the complexity of the subject. This is to be expected in the light of present knowledge of the intricate interrelationships between secretions of the ductless glands. As more information is accumulated on the physiological action of certain hormones under a known set of circumstances perdictable results may be expected to follow therapy.

NO one should attempt to create a ship without having a well designed keel upon which to build the superstructure. By the same token, the judicious use of endocrines for therapy should be based upon a sound knowledge of their basic action and effects. There has been a tendency for endocrine therapy to be carried out on a hit-or-miss plan with little actual reasoning or careful thought behind attempted treatment. Because of the intricate interrelationships between many endocrines produced by the glands of the body, a variety of treatments often produces similar clinical results.

We might read about one product labeled as an estrogen giving satisfactory results as a particular therapeutic agent, and yet in our clinical experience a product labeled as being responsible for a different physiological effect will give similar results. This has led to confusion and frustration among many practicioners and tendency to say, "What goes here?" A clearer understanding of some of the basic reactions will, perhaps, thin away the fog.

Target Organ

The first principle of endocinology that the clinician should appreciate is that there must be present a target organ. Estrogen, or progesterone and the oxytocic principle of the posterior pituitary gland exert a physiological effect, primarily on tissue layers of the vagina, uterus, and tubules. These tissue layers are target organs for the above mentioned hormones. Follicular stimulating hormone (FSH) and luteinizing hormone (LH) affect the tissue layers within the gonads in both males and females. Adrenocorticotrophic (ACTH) affects the cortex of the adrenal gland. If this specific tissue, which is a target organ for a specific hormone, is removed surgically, or destroyed by disease, or is not sensitive to stimulation by its own particular hormone, there will be little or no response to such therapy.

For example, testicular tissue destroyed by an abscess never would respond to gonadotropic therapy. Atrophied ovaries may be so degenerated and void of healthy tissue that endocrine therapy is of no avail. A uterus which has not been sensitized previously with estrogen within one or two days, will not respond to oxytocic stimulation.

We must treat healthy, functioning target organs.

*Asst. Professor Surgery & Clinics and Veterinarian-in-charge, Artificial Breeding-Bull Testing Service, Colorado A. and M. College.

Receptive Tissue

This brings us to another important concept of endocrine therapy. All endocrines must have receptive tissue upon which they can exert their influence. The target organ must be in such physiological condition to receive this stimulus and bring about an end effect. Example: Pituitrin (oxytocic principle) is most effective as a uterine muscle contractor at the period of parturition or within 24 hours postpartum. If given two to three days postpartum, or as therapy in cases of pyometra long since unrelated to heat periods, there will be no noticeable effect. Uterine tissue exhibits little receptivity to stimulation by posterior pituitary hormones 24 or 48 hours after parturition. To make uterine tissue sensitive or receptive to the posterior pituitary hormones, it must first have been sensitized by estrogen.

When a luteinizing hormone is given to a cow in early proestrum; *i.e.* three to five days previous to heat period, there will be little effect because the granulosa cells lining the follicular cavity are not yet receptive to stimlation by LH. These cells are receptive to stimulation by FSH at this period within the heat cycle and a clinical response is often manifested by conception after repeated attempts to breed have failed.

TARGET ORGAN

Specific Hormone

Hormones are specific as to the tissue they affect. The granulosa and theca cells surrounding the follicular cavity are sensitive to, and stimulated by, FSH during the period of proestrum and early part of estrum. These cells are the only cells in the female reproductive system which are affected by FSH. Luteic tissue, tubular lining cells, uterine secretory cells or uterine muscle cells are not directly affected by FSH. Its action is specific.

Later, during the heat period, and progessively so until after rupture of the follicle, the same granulosa and theca cells become receptive to LH (and luteotrophic hormone—LTH). LH now becomes specific for these particular cells. It would then be folly to attempt to bring about estrum in an anestrus cow by using FSH in the presence of an active corpus luteum. The specific cells receptive to FSH are not available when an active corpus luteum is present. The ovaries of the cow to be so treated should be examined by careful rectal manipulation and the presence or absence of an active corpus luteum determined. The findings then dictate the therapy. It is obvious to most of us that ACTH would not bring about estrum in an anestrus cow, but it is not as generally appreciated that hormones of a class, such as gonadotropins, might have effects which are just as specific within their own realm of activity.

The exact tissue or tissues which each hormone directly affects should be well understood if repeatable results follow endocrine therapy.

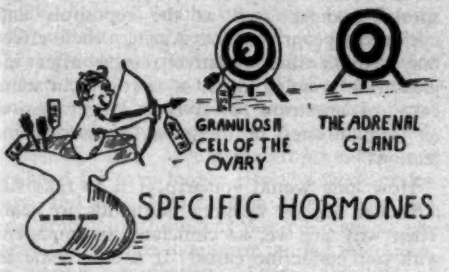
Synergism and Antagonism

The entire endocrine system, involving all the endocrine glands, should be considered as a working unit when hormone therapy is used. It has been shown quite conclusively that synergism and antagonism exists among the various endocrines in the animal body. To set down just exactly what the interreactions between all the glandular secretions are would probably be an impossible task, but if this phenomenon is kept in mind, it might explain some of the variations in responses.

Estrogens bring about an increase in blood supply to the uterus, increase the tone of the uterine muscle, bring life to the lifeless form, and sensitize its contractile muscle fibers to the action of oxytocin. But there are indications that estrogen plus progesterone do these things more efficiently and to a higher degree. The amount of endogenous progesterone being secreted by the patient's gonads may then be one reason why certain cases of pyometra respond better to estrogen therapy than do others. The relative amount of oxytocic principle being released by a given individual also would affect the progress of recovery, and account for some of our variable results. This is an example of synergism in action.

The fascinating research being conducted on induced lactation has again demonstrated the effect of synergism. It has been known for years that estrogens alone sometimes will cause

the bovine mammary gland to develop and secrete considerable amounts of normal milk. But the "sometimes" made the process impractical. Now the use of progesterone plus estrogen in certain ratio has taken considerable "chance" out of the procedure.



Research is showing us that a number of related hormones, *i.e.* related within a system, given in certain dose ratio, are more effective than single hormone injections. When the optimum ratio is disturbed, no benefits result, but antagonism developes. It is becoming more and more evident that the production of gametes of either sex is influenced by a number of hormones acting in ever-changing ratio at given periods.

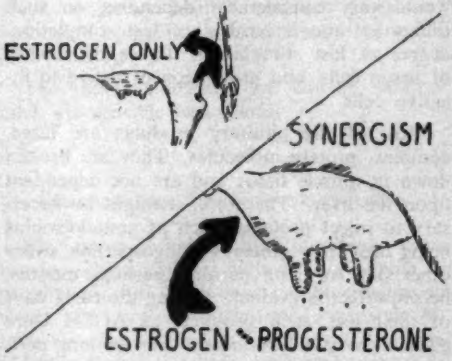
This hormonal interplay and their effects may well account for a great deal of our variable results and should only serve to stimulate the clinician to keener observations.

Physiological Doses to Create Balance

In general, the blood level of a given hormone is either increased or decreased by the presence of some other hormone circulating in the blood. The blood level of estrogens, for instance, has an effect upon the blood level of gonadotropins. An increase in estrogens tends to lower the production of, or release of, FSH from the pituitary gland. However, this phenomenon in turn apparently increases the amount of LH circulating in the body. The LH (LTH) now affects the production of progesterone which in turn creates another change in pituitary action and so on through the estrual cycles or pregnancy. Therefore, the endocrine system as a whole is a balance-counter balance phenomenon.

Therapy should be designed to adjust this balance to that most beneficial to the animal. If it is remembered that, in general, small doses of a hormone stimulate and large or massive doses inhibit the target organ, it would be possible to judge more effective treatment schedules. An example of this theory in application is the use of massive doses of estrogens to prevent threatened early abortion in women, while small doses are known to cause abortion in many species.

The axiom that a hormone depresses the gland that secretes it also illustrates the balance-counter balance concept. This inhibition usually is an indirect effect. For example, massive doses of testosterone given to a male over a prolonged period will suppress the production of gonadotropins to such a degree that testes will lose their capacity to produce either sperm or endogenous testosterone. Cessation of the testosterone treatment will allow the pituitary gonadotropins to bound back and exert a powerful effect on the hormone-starved testicular tissue. This demand created by the hormone-starved testicular tissue is often manifested by a more efficiently functioning testis than was present previous to treatment. This phenomenon also holds true in some cases, in the realtionship of hyperphysiological doses of estrogen and its effect on ovarian gonadotropic stimuli. Large amounts of estrogen given over a period of days will result in inactivity of the ovaries while dosages within physiological limits, given at the right time, apparently cause an increase in luteinizing hormone and aids in hastening ovulation. It is evident that these effects are "indirect", as stated above.

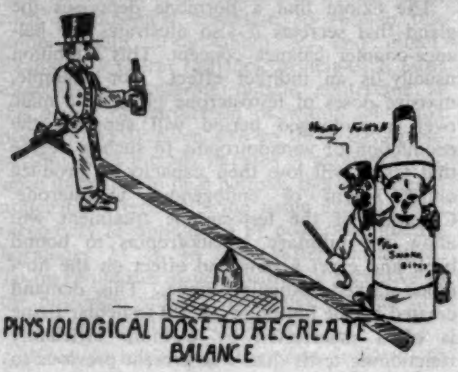


Our aim in endocrine therapy must be to restore a proper physiological balance among all the endogenous hormones related to the system with which we are working, whether it be the pituitary-gonad axis, pituitary-adrenal axis, pituitary-thyroid axis or any other system.

We may be inclined to think about hormone injections as stimulatory, but it is quite possible that it would be a more logical approach to clinical therapy if these injections were con-

UNIVERSITY OF MICHIGAN LIBRARIES

sidered as bringing certain physiological systems into balance. This would probably limit use of such radical nonphysiological doses with resulting variations.



Period of Time to Act

Since hormones are chemical compounds —steroids, or proteins, sometimes of complex structure, which must undergo certain chemical reactions leading to eventual inactivation, it is logical to assume that there must be a varied period elapsing, after injection, before effects should be noted.

Target organ sensitization and receptivity would vary considerably depending on such things as time interval since last stimulation, degree of last stimulation, degree of activity of tissue cells, and proportion of active to inactive cells.

Most of the pituitary products are large, complex, protein molecules. They are broken down in muscle tissue and are not dependent upon the liver. Therefore, it might be necessary to inject proteins, such as gonadotropins being used in treatment of oligospermia, every other day for long periods, perhaps months, before effect is evident. During the early days of their use, such products as ACTH were given by way of continuous drip for long periods before effect was noted.

Delayed absorption of protein hormones may be obtained by incorporation with such vehicles as polyvinylpyrrolidone, (P.V.P.) methylcellulose, or other carriers.

In other situations, a quick, powerful jolt is needed, as in treating ovulation failure or delayed ovulation in cattle. In these instances, the object is to hit the desired target tissue abruptly and withdraw in order not to interfere with the normal progression of a cycle. The preferred vehicle in this case is physiological saline solution or water and the product is often given intravenously at the correct time of the heat cycle.

Steroids usually are effective over about 72 hours, unless they are prepared in some special manner such as the repositols and cyclopentylproprionates. Again, the effect may exhibit itself relatively soon after injection, as is noted in use of estrogens in some cases of anestrum; or over a longer period as is manifested in treatment of uterine infections.

How long would you expect it to take for a broken leg or weeping dermatitis to heal? Then why are we, as clinicians, so impatient with our endocrine cases? If a cow came in heat every 20 days, regularly, for one year, she would have exhibited only 18.2 heat periods. Surely you would agree that at least one fourth of these "regular" periods should be manifested and the animal given all the advantages of efficient breeding before condemning the bottle of hormone we grabbed off the shelf as we ran out the office door.

A clinician should be careful in pronouncing a case nonresponsive to endocrine therapy unless time has been considered.

Reliable Product and Selection of Hormone to Give Desired Results

There are several sources of endocrines available to the practitioner. It is to his advantage to become familiar with the clinical effect of certain commercial products and if that clinical effect is repeatable, under like circumstances, then he should continue to use this product. It is not a good plan to buy an FSH from one source today and from another tomorrow, for then it may be necssary to evaluate the response of the animals to the new product.

If you are looking for an effect which is brought about by FSH—buy FSH. If you want an effect brought about by LH—buy LH. Do not expect specific results from products containing more than the specific hormone which would bring about the desired effect. Anterior pituitary extracts contain all pituitary hormones. Do not expect repeatable results under similar, given circumstances, with such a product. The results you obtain will be determined by what the relative amount of the various pituitary hormones were in the glands used for making the product.

Water soluble, low potency, estrogenic products such as dienestrol are capable of increasing the blood level of estrogen during the

heat period—the time when the follicular fluid itself is producing estrogen. Such estrogens are quickly absorbed, deactivated, and eliminated and are thus an adjunct to endogenous estrogens involved in ovulation, corpus luteum formation, and uterine stimulation. Quick, dramatic results often may be obtained with stilbestrol in peanut oil or sesame oil. These products strike hard and are effective for periods of 72 hours or so. Their most common use, then, would be in cases where stimulation lasting two to three days is desired. Repositols and cyclopentylproprionates are designed for even longer effect; a week or ten days, and should be used in cases where this long stimulatory effect is desired, such as encapsulated corpus luteum or uterine infections, or uterine sensitization. Again inhibition of other hormones should be considered.

There may be a variable effect when natural estrogens are used in a given case and when synthetic estrogens are used in a similar case. For instance, there are indications that a higher percentage of cows could be brought to milk with stilbestrol (synthetic estrogen) than with estradiol (natural estrogen) when either was given alone. Although stilbestrol is quite effective in anestrum and in cases where uterine stimulation is desired, sometimes such cases will respond to natural estrogens when the synthetic products have failed.

It is well to have one or more natural estrogens available for such situations. They may be purchased either as estradiol proprionate, diproprionate or cyclopentylproprionate. Male hormones are available in similar forms and are used correspondingly.

Remember balance-counter balance. Choose the drug which will accomplish best what you are attempting to do.

Observation and Records

Last, but most essential, is a keen observation of results, which must be obtained by careful, periodic, physical examinations of the patient with accurate recording of clinical symptoms. Without this information, endocrine therapy always will be hit-or-miss therapy. A general rule to follow is never administer an endocrine without careful examination of the system which will be affected, and careful analysis of the clinical history related to that system.

▼ ▼ ▼

Twin chicks from a double-yolked egg was reported in a recent issue of *New England Homestead*. This is the first such report in over 100 years.—*Poultry Dig.*

Stabilized Medical Fees

In his address presented at the annual convention of the American Medical Association in San Francisco, Dr. Edward McCormick, retiring president, called for stabilization of fees for medical services.

The time has passed, he said, when doctors can base a fee on the patient's income or ability to pay. Charges of some physicians may be influenced on whether the patient chooses a private room in the hospital instead of a ward, or on his address and living standards. It has been common in some areas for obstetricians to charge the prospective parents one month's salary or gross cash income for one month for care of the mother during pregnancy and delivery of a child.

An average fee for surgery and medical services should be worked out, he said.

Health insurance plans which provide specific benefits for specific services have been abused. It has not been uncommon practice for surgeons to charge double amounts insurance policies stipulate as benefits payable in event certain surgical procedures are necessary. Voluntary health insurance becomes a sham, he stated, unless definite action is taken to make its protection realistic. Unless the A.M.A. accepts the principle of average fee schedules, worked out for communities or areas, voluntary health insurance faces embarrassing competition from trends to socialized medicine.

The recommendations of Doctor McCormick are sensible and sound.

▼ ▼ ▼

Bluetongue Vaccine Available

Bluetongue vaccine, live, modified, virus vaccine, chick embryo culture, is available as prophylaxis for the control of bluetongue in sheep and goats. Concentrated research efforts by state and federal agencies and private industry assure livestock producers more and continually improved products to reduce incidence of this relatively new disease entity identified in American livestock.

▼ ▼ ▼

Continued study on the question of the safety of feeding stilbestrol to steers continues to be encouraging. A record gain of 3.43 lb. per day, for 112-day feeding period, is reported by the Iowa station for one lot of steers fed corn, hay, supplements, and stilbestrol.

Antirabic Immunization Of Cattle In Georgia Using Living Virus Vaccine Of Chick Embryo Origin

L. E. STARR*, D.V.M., M.S., Ph.D., T. B. CLOWER,** D.V.M., C. L. BROMLEY,* JR., D.V.M., and C. F. ROUTH,† A.B., M.S., Atlanta, Georgia

RABIES occurred in epidemic proportions throughout much of Georgia during the years 1944, 1945, 1946, and 1947, then began to decline in intensity. In 1946 and 1947, well over 200,000 dogs were immunized annually in the state. Thereafter, dog vaccination with phenolized brain tissue vaccine decreased except in epidemic areas or in counties or municipalities where the law was rigidly enforced. Dogs, foxes, domestic cats, wild bobcats, cattle, horses, mules, and occasionally other animals were involved in disease outbreaks. Losses of domestic animals, particularly cattle, were heavy. In the spring of 1952, cattle with an estimated value of at least $100,000. died of rabies in four west central counties.

In spite of the serious annual economic loss to farmers over many years, there is no record of controlled experiments to determine the efficacy of phenolized brain tissue vaccine against rabies in farm animals. However, hundreds of cattle were injected with antirabic vaccine, either pre- or postexposure, as a prophylactic measure. The dosage of phenolized brain tissue vaccine administered varied widely from 10 cc. to 150 cc. regardless of size or age of the animal. The results were reported as equally good, although no concrete experimental data were available as to the efficacy of this procedure. No control animals were used and all information was based on field observations or the word of the owner.

In the case of rabies, such observations involving large numbers of animals deserve consideration, but as related to individual farm units where the exposure was made by one animal, any evaluation is subject to serious error. When a rabid dog, or skunk is observed in a field with cattle, there is no way to determine, in the majority of cases, which animals actually were bitten. Except for bites on the hairless parts of the body, especially the nose, face, or mammary glands, tooth wounds are difficult to find. The hair on the body and legs, as well as the thickness of the skin, offers considerable protection and frequently masks the presence of tooth wounds. The dose of virus implanted in the injured tissues by the teeth of the rabid animal is a determining factor in the presence or absence of rabies infection resulting therefrom. Also, a good percentage of known rabid animals have no viable virus in their saliva, thus, a severe tooth wound inflicted by a rabid animal may be noninfectious for rabies.

"In a joint study carried on by the Georgia State Department of Health and the rabies laboratory of the International Health Division of the Rockefeller Foundation, an attempt was made to determine the frequency with which the salivary glands are invaded by rabies virus in animals naturally infected with the disease. Of 28 dogs proved to be rabid by isolation of the virus from the brain, 21 (75%) had demonstrable virus in the salivary glands. Of 150 foxes proved to have rabies, 130 (87%) were found to have rabies virus in the salivary glands. In a series of 34 head of cattle studied in the same way, the virus was isolated from the salivary glands of 16 or approximately 50%."

Thus, even though a rabid dog or fox actually severely bit a group of cattle, other animals, or man, there is no assurance that virus was present in the saliva and that rabies would have resulted in the absence of treatment. In order to justify the time, labor, and expense involved in the prophylactic immunization of cattle, controlled experimental data are imperative.

*Public Health Veterinarian, Georgia State Department of Public Health.

**Chief Veterinarian, Georgia State Department of Agriculture.

†Bacteriologist, Georgia State Department of Public Health.

Experimental field trial immunization of dogs with live virus antirabic vaccine of chick embryo origin was inaugurated in Georgia in May, 1949. At that time, rabies in dogs and foxes existed in epidemic proportions in much of the state. Cattle losses were heavy and there was considerable demand on the part of cattle owners and members of the State Legislature for state purchase and administration of vaccine for protection of cattle.

Cow showing characteristic facial expression suggesting clinical rabies. Note unchewed food in mouth.

This was discouraged because we had no data to indicate its real value and because it was impracticable to undertake mass cattle immunization in the absence of such data. However, because the situation was critical, four scattered herds were vaccinated[3]. The product used was from stock avianized canine rabies vaccine, 40 to 60th chick embryo passage[3,5]. The dosage employed was 3, 2, or 1 dog doses according to the age of the animals. In three of these herds, there was a definite history of exposure before vaccination. In one herd, 15 animals died between ten and 28 days following vaccination, having exhibited no symptoms ordinarily associated with rabies in cattle. "Street" virus was recovered from some of them. One calf with identical symptoms recovered. One cow in a second herd recovered after exhibiting symptoms described by the farmer as "typical" rabies symptoms, and another cow died of rabies ten days following vaccination. All other animals remained normal. Because of the conditions under which these cattle had been vaccinated, no definite conclusions could be drawn from the results.

Shroeder *et al.*[4] in 1950 and 1951, working with cattle in Honduras, demonstrated that intramuscular injection of avianized® canine vaccine was greatly superior to the subcutaneous route; also that a dose of 15 cc., or five dog doses, was adequate to induce protection against an overwhelming challenge dose of the N. Y. C. strain of street virus. A total of 4,758 cattle were immunized with the same product in an area where vampire bat rabies was endemic. There was one death due to rabies 15 days postvaccination but no other reactions which could be attributed to the vaccine.

The results obtained indicated that adequate protection against rabies was induced by this vaccine and, therefore, a similar experiment was instituted, using Georgia cattle. The regular canine vaccine was not used, but a newly developed product representing a high (above 175) egg passage of the Flury strain, which became apathogenic for intracerebrally inoculated mice, dogs, and rabbits[5].

®Lederle Laboratories Division, Pearl River, N. Y.

Safety Experiment

In order to determine the safety of the product in native cattle, 32 grade beef cattle, ranging in age from approximately four months to adult, were injected intramuscularly into the hind leg with 15 cc. avianized rabies vaccine, above the 175th chick embryo passage. These animals were observed regularly for three months during which time no illness or deaths from any cause occurred in the herd. There were no reactions except a transient minor lameness in two animals which persisted for about two weeks. It was deemed safe to proceed with the experiment.

It was then decided to conduct a field trial by immunizing a large number of cattle in areas in which rabies was endemic in both dogs and foxes. A total of 1,107 head of all ages on 29 farms, from nursing calves to adult cattle, were vaccinated intramuscularly with 15 cc. of a 33% embryo tissue suspension. Approximately 25% of the cattle in each herd was not vaccinated, to act as controls. The herds were located in the neighborhood of Fayetteville, McDonough, and Jackson, Georgia. The owners, attending veterinarians, and all veterinarians practicing in the area were notified that certain herds had been vaccinated and were asked to report any illness or deaths whether in the vaccinated or nonvaccinated groups. In addition, one of us visited the herds each week to determine the disease status. All animals that died were autopsied, the head removed and taken to the laboratory for examination. The brains of all animals and all histories were negative for rabies. In the vaccinated group there was one death from plant poisoning and one from malignant edema. Four unvaccinated controls died of hemorrhagic septicemia.

Challenge Virus Titer Determination

Twenty head of cattle, eight young animals six to ten months of age and 12 adults, were purchased at a local sale barn. Since no cattle immunization had been done in this area, it was safe to assume that these animals were rabies susceptible. Fresh suspensions of rabies infected dog salivary gland (N. Y. C. strain street virus) were prepared in serial three-fold dilutions. Four animals were used on each dilution, and 1 cc. of each dilution was injected bilaterally into each masseter muscle. Eighteen of the 20 cattle, or 90%, died of rabies, and there were no significant differences in the incubation period regardless of dilution. From these results, we can conclude only that the bovine titer of the challenge virus was greater than 1:1620. Table 1 gives details of this test.

TABLE 1. Virus Titer Determination in Nonvaccinated Cattle

Ear Tag No.	Dilution	Days to Onset of Rabies Symptoms	Days to Rabies Death	Mortality Rate
3351	1:20	27	31	
3352		18	23	4
3375		23	26	/
3354		13	20	4
3355	1:60	11	16	
3356		22	25	4
3357		23	26	/
3358		20	26	4
3359	1:180	32	35	
3360		21	22	3
3361		....	....	/
3362		18	23	4
3363	1:540	22	25	
3364		23	26	4
3365		33	35	/
3366		21	26	4
3367	1:1620	47	49	
3368		....	....	3
3369		26	31	/
3370		26	27	4

Immediately following injection of the cattle, white mice were injected intracerebrally with serial ten-fold dilutions of the same virus, shown in table 2. The results of mouse inoculation indicate a mouse ld_{50} titer of $10^{-4.75}$.

Controlled Challenge Experiment

Sixteen cattle were purchased from herds which had been vaccinated October 21 to 25, 1952 with 15 ml. of 33⅓% chick embryo suspension infected with the 187th egg passage of the Flury strain. Eight were between six and ten months of age, and eight were adults at the time of vaccination. Since approximately 6½ months had elapsed between immunization and challenge, the calves were approaching, or at, sexual maturity at time of challenge. Sixteen animals which had not been vaccinated were purchased for controls. Eight of these were young animals approximately the same age as those in the vaccinated group. The remaining eight were adult cows.

These animals were housed in a dairy barn of concrete block construction. A wooden partition was built to make an enclosure approximately 40x120 ft. A holding stock for bleeding and injecting the animals, and a single gate for entrance and exit were built in the partition. Large, double doors opened to the

outside at the opposite end of the enclosure for the removal of dead animals. Feed and water troughs were placed along one side. Two holding pens 20x20 ft. were built near the large doors. As soon as an animal began to show symptoms, it was driven into one of the holding pens where it remained until death. As an additional safety measure, a sturdy two-panel fence was built lengthwise in the center of the large, free area. Some of the animals were dangerous for a day or two and the center fence served as an escape barricade and was useful for snubbing posts, or to assist in maneuvering dangerous animals into the holding pens.

TABLE 2. Virus Titer Determination in Mice

	No. Mice	Day of Death After Virus Inoculation
Jar 1 Dil. 10^{-3}	4	9, 10, 11, 12
Jar 2 Dil. 10^{-3}	3	12, 15, 18
Jar 3 Dil. 10^{-4}	4	11, 14, 17, 17
Jar 4 Dil. 10^{-5}	3	15, S*, S
Jar 5 Dil. 10^{-6}	3	5**, S, S

*Survived
**Death from intercurrent infection

Challenge of Vaccinated Animals

The dilution of challenge virus was prepared immediately prior to injection. All animals, both vaccinated and nonvaccinated controls, were injected bilaterally in the masseter muscles, with 1 cc. of a 1:180 dilution of street rabies virus.

The cattle were injected in groups of four; one young animal and one adult each in the vaccinated and non-vaccinated groups. Four more were then selected until the project was completed. The entire operation was carried on as rapidly as possible without intermission in order that there would be a minimum of variation in the m.l.d. of the virus due to the lapse of time between the first and last animal injected. Likewise, by selecting groups of four animals representing one in each of the four age-vaccination groups, all animals within a group would be on equal bases in respect to severity of challenge. All the cattle were identified by ear tags and branding.

The results of the challenge are shown in table 3. Of the 16 animals in the control group, 12, or 75% died of rabies. Of the vaccinated group, five, or 31%, of the 16 died. All deaths were due to rabies, proved by direct microscopic examination of the brain and mouse inoculation of the brain and salivary glands.

Symptoms of Street Virus Infection in Cattle

These animals were observed by one of us once or twice daily. The symptoms were fairly uniform in all animals. The first symptom noted was loss of appetite and a tendency to stay away from other cattle. This was followed in a day or two by a more pronounced change in behavior. The affected cattle became nervous, irritable, butted other cattle, and dehydrated rapidly. The flanks were tucked in tight. Some of them could be handled with relatively no danger, others were aggressively belligerent. The facial expression was quite diagnostic. Cattle sick from most other causes have a depressed, stupid expression, eyes dull, with drooping ears. In contrast, rabid cattle have a tense, alert appearance, the head is up, eyes wide open, follow any moving object with a fixed stare, the bells of the ears are thrown forward. They were particularly sensitive to movement and sound. The noise of a moving picture camera was particularly irritating. They fought any attempt to restrain them after the first day. Rabies apparently stimulates the urogenital tract, urination was quite frequent, and many females manifested sexual stimulation. This is a quite common symptom in nature.

Some of the animals salivated profusely, others did not. A sharp noise frequently caused animals to drop as though shot, roll over on the side, and then get up quickly. Bellowing was quite constant, the head was thrown forward, back arched, flanks tucked in with eversion and inversion of the rectum. The bellow is quite characteristic in tone and persists at intervals almost until death, even in prostrate animals in semi-coma. The animals weakened rapidly, became prostrate, and died in a few hours.

A quite diagnostic syndrome noted in early rabies in cattle in the open field has been observed which is of particular importance to veterinarians on their first visit. The individual is usually alone, and may be lying down in a natural position. If disturbed quietly, it will get up quickly and trot off, lifting its feet with mincing gait, no shuffling. After going perhaps 100 yards, it will stop, turn its head, stand like a statue, and stare at its disturbers.

It will get away if possible, but is dangerous if cornered or confined.

Discussion

Under the conditions of this test, a single intramuscular dose of living virus antirabic vaccine of chick embryo origin representing the high egg passage (HEP) of the Flury strain, conferred a solid immunity to a severe challenge of virulent virus 6½ months following vaccination in 69% of the animals. The results presented in table 3 appear to indicate that immunity induced in immature animals is not of such high order as in adults. However, this has not been noted in other experiments. Serum neutralization studies, recently completed and to be published, indicate that young respond as well to immunization as mature animals. Experiments in cattle, where serum neutralization titers and challenge results were compared directly, indicate that there is a high degree of correlation. It is felt, therefore, that definite conclusions cannot be drawn on this point on the basis of the small numbers of animals used in this test, and overwhelming dose of street virus administered by direct injury of the muscles of the head (masseter).

The injection of 1,107 cattle of varying ages, nursing calves to adults, with rabies vaccine modified live virus of chick embryo origin, avianized (HEP), with no deaths due to rabies indicates safety of the vaccine.

The incubation period of the challenged animals varied from 16 to 90 days in the vaccinated group and 21 to 49 days in the nonvaccinated control group. Including both

(*Continued on page 402*)

TABLE 3. Results of Challenge Inoculation with Street Virus 6½ Months Following Vaccination with Chick Embryo Adapted Rabies Virus

	Brand	Ear tag	Age	Days to death fol. challenge	Cause of death	Negri bodies	Mouse inoculation Brain	Mouse inoculation Gland
Vaccinated 10/23/52	23	3245	Adult	S*	—	—	—	—
	27	3296	"	S	—	—	—	—
	31	8439	"	S	—	—	—	—
	35	319	"	S	—	—	—	—
	39	3241	"	S	—	—	—	—
	43	350	"	S	—	—	—	—
	45	852	"	S	—	—	—	—
	52	320	"	S	—	—	—	—
	36	3213	Calf	S	—	—	—	—
	44	3231	"	S	—	—	—	—
	47	3248	"	S	—	—	—	—
	51	3217	"	78	Rabies	+	+	+
	24	3209	"	91	"	+	+	+
	28	3246	"	16	"	+	+	+
	32	462	"	19	"	+	+	+
	40	3235	"	25	"	+	+	+
Nonvaccinated controls	46	3388	Adult	S*	—	—	—	—
	50	3391	"	S	—	—	—	—
	25	3378	"	21	Rabies	+	+	+
	29	3380	"	28	"	+	+	+
	34	3383	"	21	"	+	+	+
	38	3385	"	21	"	+	+	+
	42	3387	"	26	"	+	+	+
	48	3389	"	34	"	+	+	+
	22	3377	Calf	S	—	—	—	—
	41	3386	"	S	—	—	—	—
	21	3376	"	21	Rabies	+	+	+
	30	3381	"	24	"	—	+	+
	33	3382	"	26	"	+	+	+
	37	3384	"	21	"	+	+	+
	26	3379	"	49	"	+	+	+
	49	3390	"	30	"	+	+	+

*Survived challenge through an observation period of 18 weeks, after which they were destroyed.

Further Observations On Reproductive Ability After Recovery From Bovine Hyperkeratosis*

C. OLSON, JR., D.V.M., M.S., Ph.D., and
L. V. SKIDMORE, B.S., D.V.M., Lincoln, Nebraska

THE effect of bovine hyperkeratosis on the bull has not been fully investigated with respect to ability to recover from damage to the reproductive tract. McEntee and Olafson[2] and Olafson[3] have reported squamous metaplasia of the accessory sex glands and excretory ducts of the testes in bulls with naturally occurring, or experimentally produced, bovine hyperkeratosis. A bull which, as a calf, had developed bovine hyperkeratosis was infertile after recovery[1]. Another bull, which did not develop symptoms of the disease after having consumed a small amount of hyperkeratosis-producing feedstuff was fertile on attainment of breeding age. These observations suggest that bovine hyperkeratosis might result in permanent infertility. To further examine this question, the disease was produced experimentally in two male calves. They were allowed to recover and their fertility tested by mating with normal female animals. The results, indicating no permanent damage to fertility, are given in this report.

A previous report indicated that heifers recovered from relatively severe bovine hyperkeratosis were capable of producing calves in apparently normal fashion[1]. The possibility of damage if two successive generations were affected with toxic material capable of causing hyperkeratosis has been examined. The results are a part of this report.

Tests for Fertility of Bulls Recovered from Bovine Hyperkeratosis

Two bull calves, three months of age, were fed hyperkeratosis-producing feedstuff (lot 2 pellets remaining from previous experimentation which had demonstrated their ability to produce hyperkeratosis,[4] and prairie hay). Calf 7, a Holstein which weighed 240 lb. at the beginning of the experiment, received 42 lb. of the toxic pellets in 170 days. Calf 8, a guernsey, weighed 140 lb. and received 42 lb. of the toxic pellets in 105 days. The dosage of toxic feedstuff was deliberately kept at a low level and prolonged over a rather lengthy period in the hope of obtaining a chronic type of damage. Calf 7 gained only 20 lb. during the feeding period and calf 8 gained 15 lb. during the feeding period. Subsequent to the feeding period, calf 7 gained 119 lb. in 80 days and calf 8 gained 49 lb. in 114 days. The normal rate of gain for Holstein calves of this age on a good ration would be about 1.5 lb. per day[5]. In addition to the retardation of growth, there were other symptoms of bovine hyperkeratosis. Calves developed lacrimation which varied in degree. Skin lesions developed in both animals near the end of the experimental feeding. These were relatively mild in that they were confined to the withers, neck, and cheeks. Calf 7, developed a secondary infection of one eye which progressed to a panophthalmitis and loss of the eyeball. A proliferative stomatitis developed in calf 7 near the end of the experimental feeding. The lesions and symptoms of bovine hyperkeratosis gradually disappeared and three months after the end of the experimental feeding, calf 7 apparently was normal and gaining in weight. A chronic secondary respiratory infection and keratitis of both eyes developed in calf 8 near the end of the experimental feeding period. The recovery from the effects of poisoning were somewhat slower in this animal. Calf 8 became totally blind although there seemed to be complete recovery from the keratitis.

After recovery from the symptoms and lesions of hyperkeratosis and secondary infections, both calves grew normally and attained the size and weight which could have been anticipated if they had been maintained on normal feed.

*Published with the approval of the Director as Paper no. 650, Journal Series, Nebraska Agricultural Experiment Station. A contribution from the Inter-regional project entitled "X-Disease (Hyperkeratosis) of cattle", a cooperative study participated in by the Agricultural Experiment Station of the North Central, Northeastern, Southern, and Western regions and the BAI, U. S. Department of Agriculture.

The authors gratefully asknowledge the assistance of Mr. E. M. Brouse, Superintendent of the Valentine Substation, and members of the Department of Animal Husbandry in caring for the animals.

Fig. A. Calf in acute stage of bovine hyperkeratosis. This calf ate toxic feed pellets (similar to those fed test calves in the experiments described in this report) for six months. Note depression, salivation, and swelling of the jaw from abscess. Photo taken June 9, 1949.

Fig. B. The same calf as illustrated in fig. A but taken four months later. Note the hyperkeratosis and loss of hair on shoulder; also the shriveled condition of the horns. One horn has loosened and points downward.

Fig. C. The same calf as shown in fig. A and B but about one year later. Note the sound condition of horns but abnormal position and nearly complete recovery of skin over shoulder. Photo taken May 16, 1950.

When the bulls were 18 months of age, they were mated to females of the beef type. All of the female animals were given a gynecological examination prior to the mating to be certain they were not pregnant and were apparently normal. Subsequent to mating they were examined at various intervals for pregnancy. All of the females were intended for slaughter but the slaughtering was not done until after pregnancy was established. At time of slaughter, the fetuses were examined for any abnormality and their size measured. From measurement of the fetuses an estimate could be made of the time of conception and this correlated with service from the bull being tested. The data of Winters, Green and Comstock[5] and Nichols[6] were used as a basis for determining the rate of fetal growth.

Bull 7 was mated to five heifers 17 to 19 months of age and two cows aged 31 and 43 months. Cows had previously one calf each. The two cows and four of the heifers conceived from the bull. One of the heifers failed to conceive even though she seemed to have regular estrual periods and was known to have been bred on three different occasions. The reason for failure is not known. The only apparent abnormality was small size. At time of slaughter when 27 months of age, this heifer weighed only 675 lb.

Bull 7 was 28 months of age when slaughtered and weighed 1300 lb. Reproductive tract was apparently normal. There was active spermatogenesis and no evidence of metaplasia as described by McEntee and Olafson[8].

Bull 8 was mated to three cows from 39 to 45 months of age, each of which had previously had one or two calves. It also was mated to three heifers from 15 to 25 months of age. All animals conceived. There were some difficulties in the course of these operations because of the blindness of the bull. Some of the females were pen-mated and others were mated in a stall. On two occasions semen was obtained for examination. Spermatozoa were noted to be numerous, with normal morphology and motility.

Bull 8 was slaughtered when 33 months of age and weighed 1140 lb. Physical condition was excellent. The genital tract was apparently normal and histologic examination of the testes and epididymides revealed active spermatogenesis and no abnormality.

The extent of damage to the testes from feeding toxic pellets was investigated by histologic examination of testes removed at various intervals from 19 calves. The calves were

from three to nine months of age at time of unilateral or bilateral castration. The interval between castration and termination of feeding of toxic pellets varied from one to 116 days. Nine calves received less than 10 lb. of toxic pellets. Seven gonads examined one to 15 days and three gonads examined 40 days

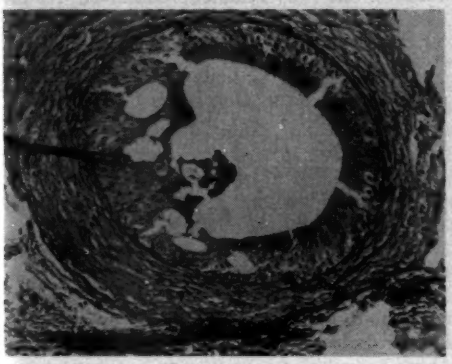


Fig. 1. Cross section of a terminal epididymal duct showing metaplasia and development of spaces in the epithelial layer. The cluster of cells in lumen suggests papillary bud formation. The tissue was obtained from a calf 11 days after a course of feeding 19 lb. of toxic pellets. Magnification X200.

after feeding indicated no change. Three of five gonads examined 15 to 40 days after feeding had some mild alterations in the epithelium of the more terminal epididymal tubules. The alteration was a mild degree of hyperplasia and metaplasia with development of intraepithelial lumens (figure 1). The gonads from three of six calves which received 10 to 20 lb. of toxic pellets revealed similar mild changes. One of these calves died of pneumonia. In its seminal vesicle there was definite epithelial metaplasia (figure 2) and a decrease of germinal epithelium in the testicular tubules. Four calves received 20 or more pounds of toxic feed. Gonads from three had a mild degree of metaplasia and canalization of epididymal epithelium and two showed a decrease in germinal epithelium. One Holstein calf had apparently normal gonads when examined 57 days after receiving 42 lb. of toxic feed.

Germinal cells were two or three cell layers deep in the tubules and normal for age of the calf (six months). The changes were observed in three of the five Holstein calves, two of the seven Guernseys, one of the two Jerseys, and two of the five grade comprising the 19 calves in the group fed toxic pellets. For comparison, testes from seven Holstein, six Guernsey, and ten Jersey calves which had been maintained on a presumably normal feed were examined. The ages at which gonads were removed varied from four to ten months. From the Holstein calves, only one specimen showed abnormality. This was intraepithelial lumens or spaces in a few of the epididymal ducts. It was a ten-month-old calf and spermatids were present. Two of the six Guernsey calves showed a single intraepithelial lumen in the tail of the epididymis. Six of the ten Jersey calves showed similar epithelial spaces and in three there was a mild degree of epithelial metaplasia. Spermatids were present in one of the gonads from a nine-month-old calf showing these changes.

From these observations it would appear that a considerable amount of toxic feed was required to cause changes in the gonads. The mild degree of metaplasia and formation of intraepithelial lumens in apparently normal Jersey calves suggests a predisposition of this breed to these changes. Similar changes occurred in four of five Holtein, one of seven Guernseys, one of two Jersey and four of five grade calves fed toxic pellets. The decreased amount

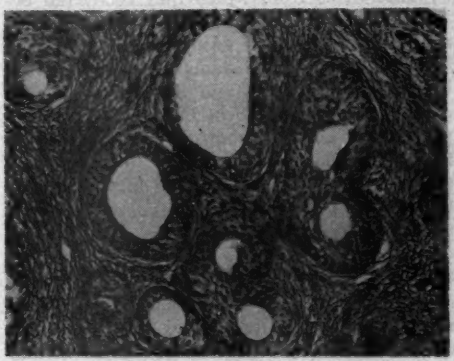


Fig. 2. Mild metaplasia of epithelium lining glandular structures in the seminal vesicle of an eight-month-old calf. The calf died 75 days after it had consumed 11 lb. of toxic pellet feed. In some areas of the seminal vesicle there was irregular budding of epithelium into lumen. Magnification X132.

of germinal epithelium seen in some of the calves receiving large amounts of pellets was not observed in any of the calves presumed to be normal. McEntee and Olafson[3] have previously reported the difficulty in observing changes in the testes of immature calves and our results confirm their observation.

Summary

These results clearly indicate that two bull calves recovered from bovine hyperkeratosis

were fertile at sexual maturity. It is reasonable to assume that the epithelial metaplasia described by McEntee and Olafson[3] occurred in the excretory ducts of the testes and accessory sex glands of the two calves. Our results would therefore indicate that the metaplasia is reversible since it was not present when the experiment was terminated. A previous observation of infertility in a bull which as a calf had bovine hyperkeratosis[2] must be regarded as inconclusive so far as the cause of infertility is concerned. The infertility could have been due to other causes.

Tests for Fertility of a Second Generation of Heifers Recovered from Bovine Hyperkeratosis

The ability of the heifers recovered from bovine hyperkeratosis to produce calves has been previously reported[1]. Heifer calves of the generation resulting from this study were fed toxic feedstuff and bred after their recovery to determine their ability to produce calves. Six dams of the heifers had relatively severe and eight dams had relatively mild bovine hyperkeratosis from which they recovered before breeding. The 14 heifers were divided accordingly into two groups, each consisting of three heifers from dams which had severe bovine hyperkeratosis and four heifers whose dams had a milder form of the disease. One group was kept as controls. The heifers of the other group were each fed 30 lb. of toxic pellets (lot 2). These were fed individually at the rate of 1 lb. per day beginning soon after weaning when the calves were four months of age. The poisoning was mild, for only two developed slight skin lesions of short duration. In three, the ulcer-like lesions were of short duration and mild. Four calves developed well defined proliferative stomatitis[7] within three months after feeding toxic pellets. The proliferative stomatitis existed briefly. Following the feeding of toxic pellets, both groups of calves were raised on pasture with supplemental soybean oil meal and corn. During the winter they received hay with the supplemental feed.

On July 1, 1952, when the 14 heifers were 14 to 21 months of age, they were pasture-mated to a Hereford bull. Previous to mating, and afterwards, gynecologic examinations were made to determine any abnormality or pregnancy. The bull was kept with the heifers for two months and all but one conceived during this period. The exception was a heifer of the control group (not fed the toxic pellets). This heifer was kept with the bull for five months before conception and was sold for slaughter before termination of pregnancy. The reason for "slow breeding" was not established. One heifer of the group fed toxic pellets aborted a six-month-old fetus. The reason for abortion could not be established. This animal was negative to repeated tests for brucellosis. She was remated, conceived readily and was carrying a calf when sold for slaughter.

The remaining 12 heifers produced normal calves at full term. One heifer (of the group fed toxic pellets) had dystocia during which the calf died. This calf weighed 84 lb. at birth. The smallest calf weighed 55 lb., was normally developed, but was killed by dogs or coyotes the night it was born on pasture.

The gestation period could be determined on ten of the 12 heifers. This varied from 282 to 300 days. There was no correlation of long or short gestation with previous feeding of the toxic pellets.

The experimental production of mild bovine hyperkeratosis in a second generation of female animals did not affect their ability to produce normal calves.

Conclusions

Although the acute phase of bovine hyperkeratosis is associated with epithelial metaplasia of the genital tract in both males and females,[3,6] the condition apparently is reversible. Two bull calves in which bovine hyperkeratosis was induced when young, recovered from the effects of poisoning and both were fertile. Heifers representing a second generation in which bovine hyperkeratosis was experimentally produced during calfhood also were fertile and produced normal calves. Thus there appeared to be no permanent damage to the reproductive tract in calves recovered from bovine hyperkeratosis.

▼ ▼ ▼

REFERENCES

1. Olson, C., Cook, R. H., and Brouse, E. M., The Reproductive Ability of Heifers Recovered from Bovine Hyperkeratosis. *Jour. Am. Vet. Med. Assn.*, 122:186 (Apr.), 1952.

2. Olafson, P., and McEntee, K., The Experimental Production of Hyperkeratosis (X-disease) by Feeding a Processed Concentrate. *Cornell Vet.*, 41:107, 1951.

3. McEntee, K., and Olafson, P., Reproductive Tract Pathology in Hyperkeratosis of Cattle and Sheep. *Fertility and Sterility*, 4:128, (Mar.-Apr.), 1953.

4. Olson, C., and Cook, R. H., Attempts to Produce Bovine Hyperkeratosis. *Am. Jour. Vet. Res.*, 12:261 (Oct.), 1951.

5. Winters, L. M., Green, W. W., and Comstock,

(*Continued on page 376*)

Stability Of Hog Cholera Virus

L. H. SCHWARTE,* B.S., D.V.M., Ph.D., and JOHN MATHEWS,* B.S., M.S., Ames, Iowa

THE interest in the stability of various field strains of hog cholera virus was more academic than real for a number of years. Postvaccination difficulties following vaccination with serum and virus in 1949 and 1950 created a critical problem in swine vaccination in a number of areas in the Midwest. Intensive studies were made from field cases concerning the cause of these postvaccination losses. Investigations were conduced by various commercial producers whose products were involved in the original vaccination, by research laboratories, and the laboratories of the Bureau of Animal Industry. Research indicated a wide variety of virus strains existing under field conditions. Some of those studied were highly pathogenic, and apparently possessed a different antigenic pattern than those used in the commercial production of serum and virus.

These unusual strains were referred to as "variants" for want of a more suitable term. These strains proved to be rather unstable after serial passage through susceptible swine. The studies on the so-called variant strains conducted in our laboratories indicated that these virus strains were quite unstable, losing their unusual properties rapidly as the result of successive passage in susceptible swine. In some instances, the original characteristics were temporarily restored by use of small amounts of hog cholera antiserum administered in conjunction with the inoculating virus. Because of the reversion of these variant strains it was later announced that they no longer existed.

The studies of field strains of virus in our laboratories indicated a wide variation in stability from the standpoint of pathogenicity. Our index of pathogenicity was based on titration studies made periodically or by successive animal passage of a given virus strain. The highest dilution capable of producing the disease in the susceptible animal was considered the endpoint of pathogenicity. While we must consider the experimental pig as a variable as far as individual resistance is concerned, swine raised from the same basic stock, under the same conditions of environment, as well as the system of feeding and management, can be regarded as reasonably satisfactory for this purpose.

The field strains of virus studied may be divided into three distinct groups. Those which show a distinctly increased pathogenicity as the result of successive animal passage; those which show a significant decrease in pathogenicity; and those which remain quite stable under similar conditions. Field strain A (fig. 1 illustrates the increased pathogenicity of a

Fig. 1. Field Strain A — Indicating increased pathogenicity by successive animal passages.

virus strain from 10^{-3} to 10^{-6} in 11 successive animal passages. Field strain B (fig. 2) titered 10^{-6} when obtained from the field and decreased to 10^{-3} level after 11 animal passages indicating a decrease in pathogenicity by passage through animals. Strain C (fig. 3) appears to be a stable strain of field virus which maintains a fairly uniform degree of pathogenicity under similar conditions.

Fig. 2. Field Strain B — Indicating decreased pathogenicity by successive animal passages.

Stability of Lyophilized Hog Cholera Virus

Lyophilization has been used for some time in laboratories for the preservation of virus. Most may be preserved satisfactorily in vacuum provided the moisture content is lowered to approximately one-half of 1% (0.5%). The

*Veterinary Research Institute, Iowa State College, Ames.

characteristics of the virus are not altered materially and the virus maintains its pathogenicity for long periods of time. The staff at the Institute maintains a large number of field strains of hog cholera virus by lyophilization; consequently it was necessary to determine its stability under various conditions. The project on the stability of hog cholera virus was initiated in June 1951 and has been carried on for more than two years. Activity

Fig. 3. Field Strain C — Indicating stability in successive animal passages.

of the virus has been tested at monthly intervals by titration methods to determine the level of pathogenicity maintained over that period. The original production of this lyophilized strain of virus was completed June 19, 1951. Although the virus was processed and placed in sealed, waterproof packets, it was not maintained under vacuum. It was stored at 4 C. except at time of sampling when the virus was subjected to the room temperatures prevalent in the laboratory. The original lyophilized virus was pathogenic in a dilution of 10^{-6} as determined on June 19, 1951. The titration of September 1951 indicated activity up to and including 10^{-5}. It maintained that level of activity until March 1952 when it dropped to a level of 10^{-4}. It has maintained that same level of pathogenicity up to date. Fig. 4 indicates the stability of this paricular strain

Fig. 4. Stability of a lyophilzed strain of virus.

of lyophilized virus for a period of 27 months under the storage conditions previously described.

Random virulence tests of lyophilized hog cholera virus were made on samples of the same strain of virus.

1. Virus lyophilized February 27, 1951. The vacuum broken, virus exposed to air and placed in refrigeration at 4 C. Tested about two years later (Feb. 1, 1953) and found to be pathogenic.

2. Second test was similar to no. 1 but the vacuum sealed tube was broken and resealed at atmospheric pressure. The lyophilizing date was March 7, 1951. The test for pathogenicity was carried out February 16, 1953. All test animals contracted the disease.

3. The third test was conducted similar to the previous tests listed above. The vacuum sealed tube containing the lyophilized virus was opened, exposed to the air at atmospheric pressure, a loose cotton plug inserted and placed on a shelf in the laboratory subject to the variations of room temperature and humidity. The lyophilization date was March 8, 1951. Pathogenicity tests were carried out on February 16, 1953. The test animals developed hog cholera.

Summary

In studies made on field strains of hog cholera virus it was found that certain strains retain a remarkable degree of stability through successive animal passages, and others may increase or decrease their pathogenicity as the case may be, under similar conditions.

A study was made for more than two years of the stability of a strain of lyophilized hog cholera virus kept at 4 C. but not maintained under vacuum. The titration made at the time of lyophilization indicated pathogenicity in a dilution of 10^{-6}. Twenty-seven months later it was pathogenic up to and including 10^{-4} dilution.

Random virulence tests of this same strain of virus under different environmental conditions indicated pathogenicity for approximately two years.

▼ ▼ ▼

Reproductive Ability after Bovine Hyperkeratosis

(*References continued from page 374*)

R. E., Prenatal Development of the Bovine. Tech. Bull. 151, Minn. Agric. Exp. Sta., June 1942.

6. Nichols, C. W., The Embryology of the Calf; Fetal Growth Weights, Relative Age and Certain Body Measuremets. *Am. Jour. Vet. Res.*, 5:135, 1944.

7. Olson, C., and Palionis, T., The Transmission of Proliferative Stomatitis of Cattle. *Jour. Am. Vet. Med. Assn.*, 123:419 (Nov.), 1953.

8. Hathaway, I. L., Trimberger, G. W., and Davis, H. P., The Use of Dried Whey and Blood Meal in the Raising of Calves on Limited Amounts of Milk. Res. Bul. 132. Nebraska Agric. Exp. Sta., October 1943.

V
FEMALE VETERINARIAN ANIMAL PRACTICE
M

Effect Of Chlorophyll Derivatives On Mating Odors Of Dogs*

H. T. GIER, Ph.D., Manhattan, Kansas

THE use of chlorophyll for elimination of undesirable odors in dogs seems to have been first recognized by Serling,[1] whose report was followed by similar reports of successful elimination of mouth, ear, and skin odors by Fawcus,[2] Worden and Waterhouse,[3] and Chilman[4]. These reports are climaxed by the work of Wright, Kohler, and Hoover[5].

Concurrent with the work on body odors, Joss[6] reported successful repression of attraction odors during estrum in 20 of 25 cases by oral administration of a water soluble chlorophyll preparation. Burkhardt and Phillips[7] reported the elimination of attraction odors of estrum in eight bitches, with return of attractiveness of the bitch to males within two days when the chorodor® preparation was not given. Fawcus[2] also reported effective use of a water soluble ultraviolet activated chlorophyll, while Worden and Waterhouse[3] reported that the use of chlorophyll did not hamper attempts to mate.

Several problems present themselves in any attempt to evaluate the various reports of success or failure in eliminating odors of bitches in estrum for normal male dogs. First, the nature of the attracting odor is unknown, but it is obviously produced in increasing quantities during proestrum until it reaches an effective concentration on the vulva and in the urine by late proestrum or early estrum, then diminishes at the end of estrum to become ineffective by the beginning of metestrum. Second, the action of chlorophyll on this unknown attractant is likewise unknown, and thirdly, it is not at all clear from published reports whether there is a threshold of effective action, or a linear relationship between chlorophyll dosage and the reduced attractant.

In order to further test the efficacy of chlorophyll derivatives in eliminating mating odors in bitches, a series of tests was devised, and provisions were made for determining effective and submarginal dosages. Most of the tests were made with bitches that were being maintained in the laboratory for studies on reproduction, but a few privately owned dogs were treated at home. A dosage of chlorophyll derivative was determined according to the weight of the animal, and the chlorophyllin powder was mixed with the feed and given once each day. Each female in estrum was checked with each of four males in rotation and then left in the pen with the males for approximately one hour each day. After the laboratory males began to recognize flirting symptoms rather than odors, an outdoor testing pen was established eight blocks from the laboratory, and the female under treatment was kept in the outside pen except for two hours each afternoon for a trip to the laboratory. Nine different males were available for checking between the laboratory and the pen, and at least six were contacted regularly each day. Untreated bitches in estrum were commonly

*Contribution No. 297 from the Department of Zoology and No. 253 from the Agricultural Experiment Station of Kansas State College, Manhattan, Kansas. This work was done as part of Project No. 321, aided by a grant from the Cerophyl Laboratories, Inc., Kansas City, Mo.
®Pitman-Moore Co., Indianapolis, Ind.

followed for one to three blocks by each of the males contacted, and untreated bitches left in the pen maintained an aggregation of one to six males around the pen continuously. The stage of estrum was determined by the vaginal smear technic described by Newberry and Gier[9]. All normal bitches showed attractiveness to males during the period in which vaginal smears contained cornified epithelial cells and no white corpuscles.

The chlorophyll preparation used (cerophyllin)* contained a metal-free chlorophyll derivative. The four special lots used contained 0.57, 0.85, 1.12, and 1.22% chlorophyll derivatives respectively. Analyses were made by a modification of the method described in the rubric of the Council on Pharmacy and Chemistry of the American Medical Association[8]. The food used at the time was a commercial dog meal containing 2% dehydrated alfalfa, and 2% dried grass, but no added deodorants. The feed contained 0.035% chlorophyll as determined by a modification of the official method of the A.O.A.C.[10].

The results of the study are described by cases and summarized in table 1. All dosages were calculated on the analyses of the added cerophyllin preparation. In all, 24 cases were tested on 18 different bitches, six bitches serving during successive estrual periods, or were tested on different levels.

Results in Selected Cases

Case 1. A 15 lb. terrier cross from which the ovaries and the entire uterus had been removed was given 2 mg. ECP (Upjohn) on February 12. This neuter was in full estrum, flirting violently on February 17, and continued to show all the symptoms through February 22. Chlorophyll derivatives (85 mg. daily) were given from February 13 to February 23. Although this dog flirted persistently, was receptive, and showed full estrum by vaginal smears, three laboratory males repeatedly sniffed and walked away. Only occasionally one of the males mounted and copulation occurred only twice (February 17 and 27) although penned with males for an hour each day. Treatment with ECP was repeated on March 17 reinstating full estrual symptoms. Eighty-five mg. chlorophyll derivatives were given daily March 19-24, and the previous results were duplicated—without a single copulation.

Case 3. A 42 lb. hound-spaniel cross that had passed one estrual period without conceiving, was given 2 mg. ECP March 3 and 10 Neilson-Cartland units of gonadogen (Upjohn) March 13. Chlorophyll derivatives in 85 mg. doses were given daily March 6-24. According to vaginal smears and behavior, this bitch was in full estrum March 10-24. Male I served the bitch on March 10. Although male I became greatly excited at the sight of this female, he was not allowed loose with her again. Attention was turned on March 15 to males III and IV, one or both of which hung with her daily until March 22. The attraction seemed to be association and flirting rather than by odors.

Case 4. The bitch used for case 3 came in estrum normally on June 1 and hung with male III before her condition was discovered. She was given 85 mg. of chlorophyll derivatives June 2 and 70 mg. daily thereafter to June 7. Male III hung with her daily June 1-7. She was not receptive to nor bothered by males I and II. She was taken out of the laboratory for four hours on June 6 and although five apparently normal males were contacted, she received no more than an inquisitive sniff. She conceived from the matings and developed six embryos.

Case 6. A 16 lb. mongrel bitch came in estrum normally and took male I on June 2. She was given 3 gm. of cerophyllin (33.6 mg. chlorophyll derivatives) on June 3 and daily thereafter until June 10. Male I hung with her daily, but the other males paid no attention to her. She was taken out for four hours in the evening of June 4 and again June 9. Five male dogs were contacted the first evening, and nine the second. None followed.

Case 7. A 62 lb. Pointer bitch in a residential area showed symptoms of estrum on April 12. She was attracting males by April 18. Cerophyllin was mixed with her feed to the extent of 10 gm. (112 mg. chlorophyll derivatives) a day April 20-29. Within 24 hours after the first feeding, the males of the neighborhood were not attracted. The bitch was chained outside or was allowed to run loose after administration of chlorophyll was begun.

Case 8. A 60 lb. Boxer bitch in a residential area showed symptoms of estrum on June 4, and administration of 112 mg. chlorophyll derivatives was begun the next day and continued for two weeks. In previous estrual periods, the neighborhood dogs kept constant vigil around her pen, but this time none bothered.

*Cerophyllin used in these experiments was supplied by The Cerophyl Laboratories, Inc., Kansas City, Mo. All chemical assays were made by the chemists of Cerophyl Laboratories.

Case 9. An 18 lb. Cocker Spaniel bitch of known estrual performance began attracting males, according to her standard pattern, on June 24. Five grams of cerophyllin (56 mg. chlorophyll derivatives) were given daily thereafter until July 6, at which time symptoms had subsided. After June 26, only an occasional male wandered through the yard but did not loiter.

Case 10. A 28 lb. Collie came normally into first estrum July 10. Chlorophyll treatment at the rate of 5 gm. (56 mg. chlorophyll derivatives) per day was begun on July 12 and continued to July 20, after which the dose was reduced to 3 gm. (33.6 mg. chlorophyll derivatives) until July 26, at which time the laboratory males quit paying attention to her. She seduced male I on July 13 but attracted no attention from the males contacted outside until July 23, three days after reduction of dosage. At that time one male that had been contacted daily for seven days, followed and tried to mount, and two others followed for a time. Three other males, all of which had been contacted previously still were not interested. She was maintained in the outside pen July 16 to July 26, during which time no males bothered.

Case 11. A 22 lb. Springer Spaniel was received July 13 in proestrum. Male I became interested July 19, and became greatly excited whenever the bitch came into view until July 26. Cerophyllin treatment at the rate of 4 gm. daily was begun July 13 and continued through July 25. This Springer was maintained in the outside pen continuously throughout this time except for the daily trip to the laboratory. None of the males contacted ever paid more than one-sniff attention, and no males loitered around the pen.

Case 14. A 22 lb. terrier came into normal estrum October 10. She was given 39.2 mg. chlorophyll derivatives daily until October 17, except October 14. She seduced male III daily October 10 to 18. She was taken, without leash, to the outside pen October 13, 14, 15, and 16 and was allowed to roam freely for three hours each of those evenings. The evening following failure of administration of chlorophyll (October 15) three attracted males stayed around the pen all night and well into the next morning. The next night, none of these males loitered, although two of them were observed passing through the yard.

Case 15. A 22 lb. Springer Spaniel-terrier cross came into normal estrum, flirted with and accepted the laboratory males October 20 through October 25. She was given 42.7 mg. chlorophyll derivatives October 19 and 20, and 30.5 mg. October 21 and 22. She was taken outside every afternoon and let run free all night October 18-24. None of the neighborhood males gave her any attention until the night of October 22, more than 30 hours after the dosage had been reduced. Attention dropped considerably the next evening after the dosage was returned to its original level, October 23, but even then two of the males returned each evening, and an unusual number of males loitered around the yard even when the bitch was not there. This was an indication that the urine spots retained the attractive odor.

Case 17. A 22 lb. fox terrier was in normal estrum November 14 to November 25. She was taken out November 15 and the three males contacted followed persistently. Chlorophyll was administered at the rate of 34.2 mg. chlorophyll derivatives November 18 to 21, when it was reduced to 28 mg. for four days. Even the males that followed her on November 15 were not interested during the period November 19-22, but two of the four males contacted after dosage reduction (November 23, 24) followed and tried to mount.

Case 18. A 35 lb. Collie was given 73 mg. chlorophyl derivatives under home conditions November 12-20 during her normal estrual period. The neighbor's dog bred her, but no others came around.

Eight other bitches were used in the tests, but are not listed here because of failure to maintain proper checks on them, principally in failure to make sufficient contacts. All of these, however, had doses within the range of 3.5 mg./kg. body weight, and were negative on the street tests, so far as those tests were conducted.

Discussion

Although previous investigators (Joss, Burkhards and Phillips, and Fawcus) have reported successful elimination of estrual attracting odors in bitches, no indication of effective levels, tolerance levels, or effect on reproduction were given.

In the present study, the consistent effective level of administration of chlorophyll was found to be in the order of 4 mg. per kg. of body weight, although apparent complete control was obtained in some cases with less than 3.5 mg./kg. It would appear that mating odors are more difficult to repress in some bitches than in others, and that some males have a keener perception of these odors than others.

TABLE 1. Results of Chlorophyll Treatment on Bitches in Estrum

Case no.	Weight lb.	Dosage mg.	mg./kg.	Days tested	Attraction
1	15	85	12.5	10	0
1A	15	85	12.5	5	0
2	28	85	6.7	15	0
2A	28	0	0	12	3
3	42	85	4.45	18	1
4	42	70	2.67	7	0
5	14	112	17.6	11	0
5A	14	0	0	3	3
6	16	33.6	4.63	8	0
7	62	112	3.98	10	0
8	60	112	4.11	14	0
9	18	33.6	4.11	11	0
10	28	56.0	4.4	9	0
10A	28	33.6	2.64	2	2
11	22	44.8	4.48	12	0
12	26	44.8	3.80	6	0
13	14	28.0	4.41	3	0
14	22	39.2	3.92	4	0
15	22	42.7	4.27	3	0
15A	22	30.5	3.05	2	2
16	17	25.7	3.32	2	0
16A	17	19.5	2.5	2	1
17	22	34.2	3.42	3	0
17A	22	28.0	2.5	2	1
18	35	73.2	4.6	6	1

Results are given by "attraction score," with 3 indicating full, normal attraction; 0 indicating no odor attraction; and 1 and 2 indicating partial attraction.

Consequently, the chlorophyll necessary to discourage some males may not discourage all.

If chlorophyll derivatives are to be given to eliminate mating odors, there is no reason for giving doubtful dosages, as the chlorophyll used in these studies was well tolerated by most of the dogs tried. Of the 35 dogs to which cerophyllin was offered in food, only one refused it and three others left the chlorophyll-laden food until last, but ate it. It would appear that levels up to 8 mg. per kg. body weight would be acceptable for most dogs, and some do not object to twice that amount.

Chlorophyll, at levels given, did not affect the behavior nor the functioning of the bitch. The normal estrual cycle ran its course with the regular vaginal discharges, and copulation resulted in normal pregnancies. The only detectable change brought about was the loss of attracting odors, so that males did not follow the bitch. In most cases, however, this loss of attracting odors did not interfere with copulation for any length of time when the bitch was confined with a male, and the laboratory males soon learned to function without the aid of odors, apparently by the reaction of the bitch.

Wright, Kohler, and Hoover[8] determined that 0.49 mg. chlorophyll derivatives per kg. of body weight gave 50% deodorization for odors detectable to man. Such levels of chlorophyll can be given to any bitch without fear of keeping the males away, as it was found in this study that dosages lower than 3 mg./kg. weight were always non-effective.

Worden and Waterhouse[9] reported that the administration of 33 mg. chlorophyll to a ten-pound dog was ineffective. If their chlorophyll was assayed according to the same standards used for the present study, it should have been completely effective in blocking male attraction, as that dosage is considerably above the effective dosage (7.3 mg./kg. as against an effective 4.0 mg./kg.). It is possible that the chlorophyll derivatives they used were not so readily available as are those in cerophyllin or that the assays were not conducted in the same way. Joss[6] reported highly effective check dosage by the use of one "65 mg. tablet assaying 20% sodium chlorophyll" for each 20 pounds of dog. According to obvious calculations, this would mean 13 mg. of sodium chlorophyll for 20 pounds of dog or 1.43 mg. per kg. This level was found, in the present study, to have no measurable effect on male response.

Munsch[10] reported 25 mg. chlorophyllin per day per dog to be effective but did not state the size of his dogs. According to the threshold level determined by the present work, that dosage would be effective on any dog weighing less than 6.2 kg. Only a slight difference in assay technic easily could account for such a variation.

Serling[3] used one chlorodor tablet (100 mg. chlorophyll) for each 25 lb. body weight, which would be 8.8 mg./kg. if the 100 mg. is the actual chlorophyll derivatives in these tablets. A sample of chlorodor assayed in the same way as was the cerophyllin used in this study checked 22.5% sodium-chlorophyll. If the "100 mg. chlorophyll" refers to the mass continuing 22.5% chlorophyll derivatives, then the actual dosage (1.98 mg./kg., is somewhat below the effective level of cerophyllin.

Burkhardt and Phillips[7] administered three 100 mg. chlorodor tablets daily, and "male dogs ceased to appear." If 300 mg. assaying 22.5% chlorophyll derivatives were administered to a 25 lb. dog, the dosage level was 5.95 mg./kg. This is well above the effective level established by the present study.

The discrepancies in reports are much less significant than is the point that in trying a

(Continued on page 391)

X-Ray Machines And Related Physics†

L. G. IDSTROM, M.D., Minneapolis, Minnesota

X-RAY machines and their circuits are best understood by knowing the fundamentals of physics, particularly through a working knowledge of properties and production of electricity and *x*-rays or roentgen rays. These *x*-rays or waves of radiant energy, aptly described as "harnessed lightning", have the unique power of marked penetrability of objects, and when directed through a part or parts of the animal body, pass through in varying quantity and quality to give visualization of hidden structures because of their further effect on photographic film or their fluorescent effect on certain forms of matter. The roentgen ray machine, an electric generator or device for the transformation of energy, develops, accelerates and stops, or controls electrons, those negatively charged particles of matter, which bombard a target (anode) producing remarkable emanations as a result. Electricity (loosely described), or electric current, is a flow of negatively charged particles (electrons) along a conductor (usually wire) and the property of the current-carrying wire, *i.e.*, the ability of its atoms or molecules to hold or lose electrons in their outer orbits determines a good conductor of electricity or a bad one. The perfect bad conductor (one which will not relinquish its hold on electrons in outer orbits) then becomes the best insulator.

The force (pressure) resulting in electron flow is called electromotive force (emf) and is measured in single units referred to as volts (E) or 1000-volt units called kilovolts (KV). The quantity of electron flow (current) is measured by the number of electrons flowing past a given cross-section of wire with the unit known as a coulomb. With a known quantity flowing past a point per second a unit is developed, the ampere (I) or the milliampere (MA) equal to 1/1000 ampere. Voltage (E) and ampere (I) are affected by the resistance (R) offered to the electron flow by the atomic and molecular masses due to their structure, arrangement, or anything which impedes electron flow within the circuit. One can now readily understand the effect of friction caused by the tremendous number of electrons moving at tremendous speeds and often colliding, again causing a transformation of energy, but this time as a detrimental waste product—heat. By Ohms Law resistance (R) measured in ohms (O) offered by a conductor of electricity is equal to emf (E) divided by quantity of current flow or amperage (I) divided by resistance (R). This law resolves into the equation:

$$R=\frac{E}{I} \quad \text{or} \quad I=\frac{E}{R} \quad \text{or} \quad E=IR$$

Since power is needed to do work and we are concerned with electric power in present-day production of roentgen rays, we find that such power measured in watts (W) is equal to voltage or pressure (E) multiplied by amperage or current flow(I). One volt of pressure resulting in a current production of one ampere will therefore produce one watt of power. The standard unit of measurement, however, is the kilowatt hour.

To summarize, the *x*-ray machine (generator) must produce actual electrified particles (electrons). These electrons must be produced in enormous quantities and be accelerated to high velocity. They must bombard an obstruction (target or anode) in their path. As a result, the electrons are suddenly stopped and a transformation of energy occurs with production of waves of radiant energy known as *x*-rays or roentgen rays. In the process, an electric charge has been lost but new powers have been gained. We now have a new form of energy with the powers of extreme penetrability of mass and photosensitive and fluorescent effects.

Physics Fundamentals

Preliminary fundamentals are necessary for the understanding of basic concepts of electricity. According to the law of conservation of matter, it can neither be created nor destroyed, but it can be changed (subject to the coming of age of the "atomic era"). From the law of conservation of energy, we find that energy can neither be created nor destroyed, but it too can be changed.

Matter and energy are closely related. Electrical energy changes occur because of elec-

†Presented at the 20th annual meeting of the American Animal Hospital Association, Minneapolis, Minnesota, May 6-9, 1953.

tron flow, and since electrons are actual electrified particles, we can visualize more readily this relationship between matter and energy.

Matter, anything which occupies space and has weight, may be solid, liquid, or gas and the amount of matter which the substance, body, or thing contains is its mass. When this matter has been broken down into its most minute form, but still retains its original and specific character, we have reached the molecular state with its subdivision, the molecule. By chemical division (electrical, chemical, heat, light, *x*-ray) energy transformation further divides molecules into simple molecules containing two or more like atoms (elements) or compound molecules which contain two or more atoms of different kinds.

Atoms are produced by dividing molecules into their final limits of chemical division. These atoms are constellations of electrons arranged in a ring system (very like our solar system) in the center of which is a positively charged nucleus. However, the simplest atom—hydrogen (H) is composed of a single positive (+) charge or proton with atomic weight of one and with a single electron or negative (-) charge circling around its central nucleus and held by an attraction from the equal but positive force of this single nuclear charge (unlike electrical charges attract).

Atoms of elements become more complicated in their structure, but fundamentally, each nucleus contains a proton for each electron present in its orbit or orbits. As the atoms increase in size their nuclei contain neutrons in addition to protons—neutrons being neutral electricity since they consist of a proton with an attached electron.

Electrons can be disturbed in their orbital relationship by "outside forces" such as friction, electricity, *x*-rays, heat, light, or other possible ionizing agents and although the ionization is only transient, it is the key to our basic interpretation of changes which occur in our electrical circuits.

These forces which displace or remove electrons from their orbits cause ionization as noted. This phenomenon, resulting in the liberation of an electrical charge, clearly illustrates fundamental electron flow. We can now see that those atoms and molecules whose outer orbit electrons are readily disrupted (ionized) and transferred to outer orbits of other electron systems are *good* conductors of electricity, while those molecular structures with electrons not readily disrupted from their orbits are *poor* conductors—better described as insulators.

Further necessary information is given here as an additional summary regarding electrons, protons, and neutrons. The electron is the smallest known measured quantity of elec-

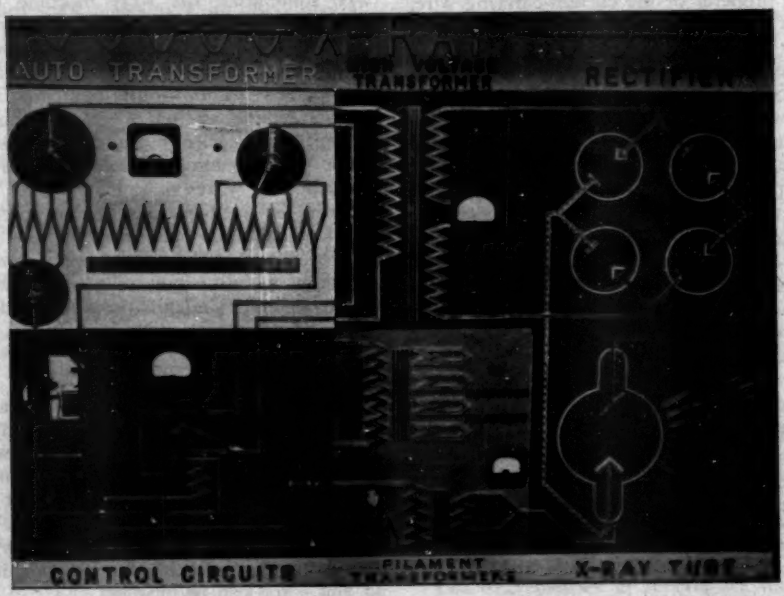


Photo courtesy Medical and Biological Illustrations

Fig. 1. Mock-up of the electric circuit of a typical diagnostic X-ray machine using parallel, distinctively coloured, and selectively illuminated plastic strips and plastic electrical symbols controlled by electonic devices.

tricity. It has mass, therefore occupies space and has weight, this weight being 1/1800 the weight of its opposite charge, the proton. Electrons, as like charges, repel each other with a force in inverse proportion to the square of the distance between them.

The proton already described by weight and charge is then the heavier charge and is the unit of mass in the nucleus. The neutron is a unit composed of a proton which has attracted an electron with the production of a neutralized particle. Other than this drab statement and the fact that it is associated with protons in atomic nuclei, it is to be remembered because it explains the presence of isotopes.

The X-ray Circuit

Many requirements must be fulfilled by the roentgen ray machine (see models in figs. 1 and 2) for the production of *x*-rays in our present day circuits. We must produce, accelerate, and stop electrons. These electrons must have the ability to produce *x*-rays of varying penetrability depending upon the thickness of the body or parts which we wish to examine. Increasing voltage will increase this penetrability by accelerating and increasing the force of electrons flowing from cathode to anode. The quantity of electrons flowing, however, is increased by increasing milliamperage and this variable will affect the quality of our *x*-ray beam in the production of satisfactory fluoroscopic images or photographic records. Milliamperage is controlled by a resistance (rheostat)) or more efficiently by a choke coil—a device dependent upon back emf. It is a solenoid with a movable iron core. This control is placed in the primary circuit.

Control Circuit

The autotransformer is a dual voltage control device. It stabilizes incoming line voltage and is therefore the line voltage compensator because it makes possible the selection of standardized voltage for varying incoming power. Further, it becomes a pre-selector of voltage which is applied to the primary of the high tension transformer, because a chosen low voltage (determined by major and minor tap selection) will be "stepped-up" to the same degree each time it goes through the secondary of the step-up transformer whose primary and secondary are not variable as to their number of turns of wire. Known and uniform kilovoltage then becomes assured.

Special Controls

Controls of various types are essential on modern machines and their number and type vary with the complexity of the machine and its circuit.

Switches and fuses control circuits from outside power mains. Circuit breakers are inserted to care for overloads. A timing unit is essential and is closely associated with the contactor in the control panel. The timer (clock or impulse type) regulates the contactor (electromagnetic) which opens and closes the primary circuit of the high voltage transformer. This unit therefore controls the start of electron flow, acceleration, bombardment, and stoppage of electrons.

Step-up and Step-down Transformers

When the secondary coil contains more turns of wire than the primary, the transformer is a step-up type (see *x*-ray machine diagram) and when the primary coil turns exceed the turns in the secondary coil we have a step-down transformer.

Alternating current is now available at any voltage. This voltage in the secondary will be in a direct proportion to the turns of wire which it has in relation to the turns of the primary (more turns equal more voltage and vice versa), but the amperes of current are in an inverse ratio (more turns; less amperage). Remembering Ohms law, we see that primary volts (e) x amperes (I) equal secondary volts (E) x amperes (i) considering resistance to be constant for ease of calculation. Efficient transmission of power depends upon this finding.

Remembering that self-induced back emf occurs in a coil, we see that there is little current in the primary of the transformer when no load is drawn from the secondary, but with a load on the secondary, back emf decreases in the primary and increased current flows to build up the load for the transformer.

Rectification Circuits

It is essential to change alternating current to direct current in an *x*-ray circuit. If the anode is positively charged and the cathode has a negative charge, electrons will then flow from cathode to anode when the cathode has been heated to incandescence. It can therefore be seen that the *x*-ray tube will function as its own rectifier but only during one half of each cycle. Should an *x*-ray tube overheat, however, it can be seen that electron flow is possible with both alternations of the electron flow, the overheated anode now serving as cathode and the filament as target—to its great detriment.

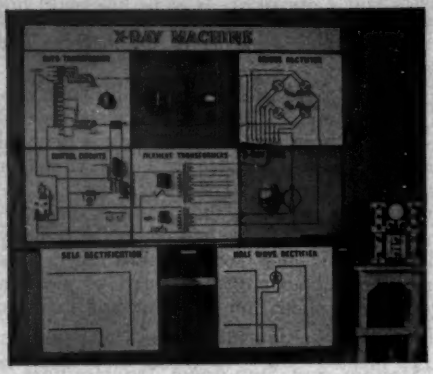


Photo courtesy Medical and Biological Illustrations

Fig. 2. Demonstration X-ray set. Full-wave rectification panel in circuit. Interchangeable self-rectification and half-wave rectification panels seen below machine panel. Hand timer at left. Oscilloscope at right.

A demonstration *x*-ray machine (see figure 2) by use of substitution panels, will illustrate self-rectification (by *x*-ray tube); half-wave rectification (by *x*-ray tube with one valve as a protective mechanism); and full wave rectification (with four valves using both alternations of each cycle).

Self-Rectification

The *x*-ray tube serves as its own rectifier in most portable machines. The self-rectifying circuit was also highly successful in all U. S. Army field and hospital portable units. It has its limitations because current is flowing only every half of each cycle. Consequently milliamperage is halved. As already noted, a high inverse voltage "pounds" the anode of the *x*-ray tube during the second half of each alternation.

Valve Rectification

We may use valves (thermionic rectification) which suppress half of each cycle — as does the *x*-ray tube, the principle being the same. A high tension current will flow from heated cathode to plate but not from plate to cathode (valve or one way effect). Both halves of the cycle or alternations of current flow may be used by proper placement of valve tubes in the circuit. Inverse voltage is eliminated doubling the efficiency of the circuit.

Half-wave Rectification

In using one or two valves in a circuit, we depend upon the *x*-ray tube for production of rectification from alternating to direct current, the thermionic valve serving as the suppressor of inverse voltage on the anode side of the *x*-ray tube, thereby raising its efficiency.

Full-wave Rectification

Proper placement of four valves in the circuit—a bridge rectifier—results in rectification from alternating to direct current with use of both halves of the cycle, doubling the efficiency of the machine. Note the doubling of milliamperage in demonstration circuit when demonstrating change from half to full-wave rectification.

Mechanical Rectification

By means of a reversing switch synchronized to the cyclic alternations of the current, accompanied by incorporation of a motor, current flow from transformer to *x*-ray tube is reversed with each half-cycle of the alternation in current flow. Full wave rectification is therefore accomplished by mechanical means. Advantages: Uniform kilovoltage results at peak of performance and machinery is relatively simple. Disadvantages: Bulky, high tension, noisy equipment is necessary.

Roentgen Ray Tube

Great changes have occurred in the heart of the *x*-ray machine—the tube. Roentgen's tube was a bulb containing a cathode and an anode. This tube was partially evacuated of air and the gas still remaining became ionized. making it possible to produce an electron flow for bombardment of the anode. Later, gas tubes contained anode, cathode, and anti-cathode. The amount of current which flowed through the tube depended upon gas pressure within the tube. A gas pressure regulator therefore became an integral control unit on the tube. Detail was poor because of the scatter of *x*-rays at points other than the focal spot.

The Coolidge tube (hot cathode) was the development of greatest advancement. This tube, highly evacuated, contained a coiled fine tungsten wire, for heating the cathode. This filament, heated to incandescence became the source of a large number of electrons variable with current flow (increase milliamperage for increase of current and quantity of *x*-rays will increase). The target, a block of tungsten set in a heavy copper molybdenum rod, is directly across from the cathode. Heat production in enormous quantities as a waste product of *x*-ray production was never dissipated properly until the radiator fin attached to the copper molybdenum anode (of high heat conductivity) brought the tube to an efficiency which still makes this tube basic equipment.

A further advance in tube construction came

with the development of the rotating anode—an electrically driven target—which produces a small but constantly changing focal spot because of its continuous rotation during *x*-ray production.

Oil immersed tubes with circulation of oil, water jacket tubes, thermostatic controls and numerous additional improvements and safety devices have been made and are available features in tube equipment.

Summary

Roentgen rays, discovered by Wilhelm Conrad Roentgen in 1895, were designated by him as *x*-rays. They were one form of radiant energy with the properties of light, but infinitely shorter, giving them great penetrability, thus giving them the ability to pass between the atoms and molecules which make up the solid, liquid, and gaseous components of the body.

X-rays are formed whenever electrons strike a solid target in their path. The greater the speed of the electrons, the greater their impact upon the target; and the greater the impact, the shorter the *x*-ray with resultant greater penetrability. Greater speed and impact are attained by increasing kilovoltage and intensity of radiation, determined by increasing current flow or milliamperage (raising filament temperature increases electron flow).

In summarizing, *x*-rays are seen in their proper place within the electromagnetic spectrum as follows: Hertzian waves (broadcasting band, radio short waves, centimeter waves); infra red (heat) waves, visible spectrum (red, orange, yellow, green, blue, indigo, violet); ultra violet, *x*-rays, gamma rays, (emitted by radium), and cosmic waves (shortest).

These *x*-rays radiate in straight lines, are not divided by electromagnetic fields (as are electrons), have the speed of light, ionize gases, and penetrate all substances (to a greater or lesser degree). They affect the photographic film and produce fluorescence in some crystals of matter. Finally, they produce secondary radiation of *x*-rays when they strike matter and they cause irritation of living cells or death of these cells when they are emitted to an excessive degree.

Together with the above facts, proper kilovoltage and milliamperage selection in relation to time factors and evaluation of bodily characteristics of patients, will enable the doctor or technician to present a proper fluoroscopic or photographic image.

(Continued on page 388)

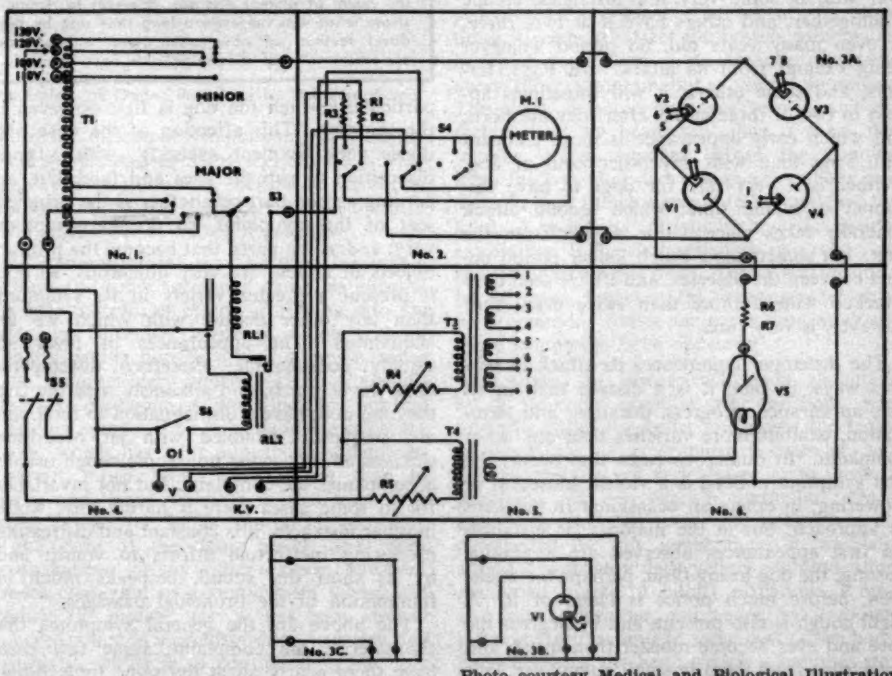


Photo courtesy Medical and Biological Illustrations

Fig. 3. Diagram of circuit on back of demonstration board shown in Fig. 2 with full-wave rectification (No. 3C) are shown in smaller diagrams below. See Am. Jour. Roentgenol. 55:224, 1946.

The Distemper

from Canine Pathology by Delabere P. Blaine (1770-1845)

The accompanying is a total quotation on "The Distemper" from Canine Pathology by Delabere P. Blaine, 1817 (1851 edition, pp. 42-47) submitted by Dr. J. R. M. Innes, chief, Pathology Branch, Chemical Corps Medical Laboratories Army Medical Center, Maryland, with his essay, Canine Pathology: A Historical Essay on Some Pioneer Contributions of D. P. Blaine (1770-1845). (See VETERINARY MEDICINE, 47:242 (June), 1952).

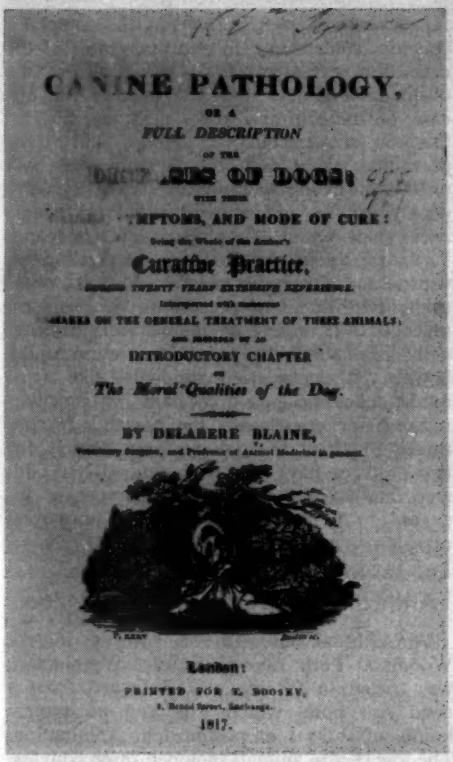
In commenting on Blaine's observation on canine distemper, Doctor Innes stated, "His contributions could replace clinical descriptions in man modern veterinary textbooks, and there would be little lost that is of value."

Blaine's treaties might serve as a lesson for students and others aside from teaching humility. History by itself, no matter on what subject, has an intellectual value, and one wonders whether it is opportune for veterinary schools to follow the example of most medical schools, and introduce a short course on veterinary history into the curriculum—not for examination purposes. In the realm of animal diseases, it serves to demonstrate what was achieved a long time ago by the direct method of observation, and without the armamentarium of diagnostic aids now available.

This loathsome complaint, though now so general and common, does not appear to have been known a century ago; and even yet, throughout the European Continent, it is considered as an epidemic that visits the different countries every three or four years. In the *Grand Encyclopédie Méthodique the disease is thus described. "Il c'est jetté, il y a quelques années, une maladie epidémique sur les chiens dans toute l'Europe; il en est mort une grand partie sans que l'on pût trouver de remède aumal."—Livraison LIX Chasses.* But now, in England at least, hardly any dog escapes it; from a constitutional liability born with the animal, and which is brought into action either by force of the predisposition, or by the agency of some occasional cause, as cold. In most instances, the attack occurs either before or about the period that a dog attains his full growth. Dogs however will, in some very few instances, escape it altogether, and others have it at two, three, or even many years old, no period whatever being exempt from its attack. In Pugs, terriers, and some others, it will sometimes appear in two or three weeks after they are born; and which early appearance is more frequent with Pugs than with any other kind of dog. Neither is it very rare for dogs to have distemper a second time; which second attack generally takes place within a year from the first: but sometimes a much longer period occurs between the illnesses, and I have seen dogs attacked with it more than twice even; this, however, is very rare.

The distemper commences its attack in various ways; in fact, it is a disease that, in its rise, appearance, progress, duration, and termination, exhibits more varieties than any other complaint. In numerous cases that occur, the first symptom noticed is a violent looseness or scowering; in others an occasional fit betokens its approach; but in the majority of instances the first appearances observed are a gradual wasting; the dog losing flesh, perhaps for weeks even, before much notice is taken of it. A slight cough is also present, and by degrees the nose and eyes become moister than usual, and water runs from them in small quantities. This watery moisture soon changes to pus or matter, and the eyes and nose appear glued up with it, particularly when the dog is first observed in the morning. This affection of the nose produces very frequent sneezing, with a great disposition to rub the eyes and face; but, according as one part or another is the principal seat of the complaint, so do the symptoms vary; and as the parts, that become the primary objects of attack, are very numerous; so does it present a greater variety in its symptoms than any other disease with which we are acquainted. The appearances of fever are usually considerable; therefore distempered dogs shiver much, and anxiously seek the fire; they are dull, have a disinclination to food, and are frequently troubled with an occasional sickness and throwing up. Some cough usually accompanies the complaint, but not invariably; for in some cases there is hardly any; while, in other instances, it is constant and distressing, producing ineffectual efforts to vomit; and, by its short dry sound, bespeaks much inflammation of the bronchial passages.

The above are the general symptoms that characterize the complaint; some few cases have them nearly all at the same time; others have some only. The varieties are immense; but it may be considered as certain, that


CANINE PATHOLOGY,

OR A

FULL DESCRIPTION

OF THE

DISEASES OF DOGS;

WITH THEIR

SYMPTOMS, AND MODE OF CURE:

Being the Whole of the Author's

Curative Practice,

DURING TWENTY YEARS EXTENSIVE EXPERIENCE.

Interspersed with numerous

REMARKS ON THE GENERAL TREATMENT OF THESE ANIMALS;

AND PREFACED BY AN

INTRODUCTORY CHAPTER

ON

The Moral Qualities of the Dog.

BY DELABERE BLAINE,

Veterinary Surgeon, and Professor of Animal Medicine in general.

London:

PRINTED FOR T. BOOSEY,

1817.

Frontispiece of Canine Pathology by Delabere Blaine

no dog has distemper without some of these detailed symptoms. In some the disease is very long, even many weeks, before it arrives at its height; in others, it appears in full force in a few days after it makes its attack.

Its commencement may be very frequently attributed to some accidental cause, as unusual exposure to cold, et cetera. Throwing into the water, or carelessly washing a dog without properly drying him, is a very common cause of it. Another very general origin of the disease is in contagion. A dog which has not had it, seldom escapes if he remains in the company of one which has it. It appears at sometimes, however, much more easily taken than at others, and, when imbibed in this way, it is longer or shorter in its approach, according to the state of the dog's health and other circumstances. Many other causes, however, besides contagion or a simple cold taken, will produce the disease; for, as has been already observed, there is a predisposition in every dog towards it, which is so considerable, that any derangement in the system is sufficient for the purpose. I have seen it brought on from violent haemorrhage, and also from an occasional alteration in the food; but this alteration has been from a full to a low diet. Full feeding, on the contrary, I regard as a preventive; and it certainly is prudent to keep puppies well, particularly those exposed to distemper; for I have ever found those least obnoxious to its attack, as well as fare best under the disease, which were in the best condition.

Some breeds also have it much worse than others; so much so that a whole litter of one bitch will die, while a litter of another bitch will have it very mildly. Particular kinds of dogs have it also more violently than others. It is very fatal to Pugs and Greyhounds; terriers have it likewise badly: and it may be regarded as a general rule that the younger a dog has it, the worse will the disease prove. Very young puppies seldom live with it.

As has been before stated, the immediate part of the body that it makes its primary attack upon is various, according to circumstances. It commonly is first observed in the head but does not always remain wholly there, soon spreading itself to other parts; sometimes to one, sometimes another. When it exists principally in the head, it produces sneezing, watery eyes and nose, and every appearance of a violent cold taken. At other times it seems to affect the bowels principally, in which cases there is an absence of almost every other symptom but a violent looseness. The chest, in some instances seems more affected than the head, and then a short distressing cough appears before the running from the nose and eyes commences. Now and then the first attack appears to be made on the loins; a weakness in which, and the hinder extremities, is the first symptom observed: but this originates in the head. In the greater number of cases, however, this weakness, which is very common, comes on some time after the other symptoms have appeared.

In some, the disease will make its attack by an universal eruption over the body, particularly under the belly, and down the inside of the thighs. This eruption is pustular, and the pustules are not very dissimilar to those of smallpox. In one year in particular, almost every case that fell under my notice was accompanied by this appearance. It was also attended with very deep yellow-coloured urine, and great marks of biliary affection. I have also seen distemper commence by a violent inflammatory tumour in some part of the body, particularly of the head, which sometimes proceeds to suppurate; but this is not a common mode of attack.

The distemper is very frequently attended with convulsions; it is also now and then preceded by them. These convulsive affections are of two kinds: one is a simple paralytic affection, which, in addition to the weakness, frequently leaves a spasmodic twitching also in one or more of the limbs for life. The other is a perfect fit, in which every part of the body becomes convulsed and strangely contorted, attended sometimes with a total, sometimes with only a partial, mental alienation. When distemper is preceded by one of these fits; or when, very early in the complaint, an occasional fit now and then occurs, such a dog is not unlikely to recover; but when the disease has made some considerable progress, and fits come on, followed, in succession by each other, the animal very seldom recovers. The fits of distemper appear frequently trifling at first, and produce only a slight champing of the mouth, with a little froth; from which state a dog may be almost immediately brought out by throwing cold water in the face, or by coaxing and kindness, which will likewise often do it. These fits, when they have once appeared, gradually strengthen, and, becoming more obstinate, they wear down the animal on the second or third day from their appearance.

When a dog has become emaciated from the disease, and his appetite has failed it often happens that he suddenly appears more cheerful, eats heartily, and his eyes brighten; but these appearances are fallacious, and commonly denote that fits are approaching. If the appetite becomes at once, not only considerable, but greedy, and the eyes look very bright and sparkling, the event may be considered as certain. In some instances, the sudden stopping of the looseness is, likewise, the forerunner of the convulsions; but this only happens when the stoppage takes place of itself. When the looseness, or diarrhoea, is overcome by medicine, such an event rarely occurs.

Another type of the complaint is that of a malignant putrid fever, in which there is great emaciation, extreme weakness, a total loss of appetite, accompanied with an enormous discharge of matter from the eyes and nose, but particularly from the latter. The discharge, as the disease verges towards its latter stages, becomes bloody and very foetid; and the whole body likewise emits a cadaverous effluvia. This putrid state is very difficult to cope with, and commonly wears the animal down, by the violence of the discharge, and the putrid alteration effected in the solids and fluids of the body.

The distemper appears also to vary in different seasons, and the type of the complaint becomes epidemical. In one year, most of the cases that occur prove distressing, from the obstinate looseness that accompanies the disease; on the contrary, in the next year little of this will be seen, but fits, perhaps, will be the prevailing symptom, while the third year will exhibit the complaint in a most putrid malignant form; but actively inflammatory appearances shall rage in less proportion. In general, I have remarked, that fits are most prevalent in winter, and purging in summer: but, like other rules, these admit of exceptions. In the summer of 1805, many of the subjects affected with distemper had a peculiar affection of the bowels. It commenced suddenly, like spasmodic colic, and gave great pain, but it neither relaxed nor constipated the bowels. It continued to affect the patients very acutely for two or three days, and then generally terminated fatally. Those cases that did recover appeared to be benefited by active purgatives of calomel and aloes.

▼ ▼ ▼

Anthrax Outbreak in Seattle Zoo

An unusual outbreak of anthrax in the Woodland Park Zoo in Seattle, Washington, was traced to feeding meat salvaged from a dead zoo pony which exhibited no typical lesions of anthrax on postmortem examination. The loss of zoo animals included three cougars, 14 raccoons, three bobcats, two coati mundi, and two badgers. Six additional cats were treated on evidence of early symptoms of disease, and all the lions, tigers, leopards, and others fed the meat were treated successfully with antibiotics.

▼ ▼ ▼

X-Ray Machines

(Continued from page 385)

REFERENCES

1. Williams, M., M. D., PH.D., An Electric Model of an X-ray Machine. *Radiology*, 38:338, 1942.
2. Eddy, C. E., A Composite Model X-ray Generator. *British Jour. Rad.*, 18:61, 1942.
3. Strong, J. A., Two Forms of Electronic Switch. *Jour. Sci. Instru.*, 17:275, 1940.
4. Idstrom, L. G., Langford, H., and Baker, W. P., A Demonstration Roentgen-Ray Machine: 'Live' Circuit Diagram Model. *Am. Jour. Roent. Rad. Ther.*, 15:224, 1946.
5. Idstrom, L. G., The Development of Teaching Models of X-Ray Equipment. *Med. Biolog. Illust.*, 2:113, 1952.
6. Idstrom, L. G., Model X-Ray Machines, X-Ray Circuits, and Related Physics. Published by and for the American Society of X-Ray Technicians.
7. Life Magazine, The Atom, May 16, 1949, pp. 68-88. (Reprints available from Dept. A, Life Magazine, 9 Rockefeller Plaza, New York 20, New York. Color filmstrips also available).

Emetics In Small Animal Practice

LEON F. WHITNEY, B.S., DVM., and
GEORGE D. WHITNEY, D.V.M.,
Orange, Connecticut

Most of the studies on the use of lentin® (carbaminoylcholine chloride) have concerned its use in large animal practice. In 1943, the writers were attempting to find a good, quick-acting emetic which could be given with a purgative for emptying the entire alimentary tract, for use in cases of poisoning. Several combinations of drugs were tried including hydrogen peroxide and lentin (1:10,000), recommended for small animal practice.

One day a case was scheduled to receive a 50% solution of 3% hydrogen peroxide in water *per os* (standard remedy used for emesis) to be followed by a laxative. Lentin was chosen as the laxative agent. No 1:10,000 solution was available, so it was decided to try 1/10th as much of the 1:1000 solution prepared for large animal use. This was injected subcutaneously. The dog fought the peroxide and would not swallow it. While an attendant went for a stomach tube, the dog vomited a huge amount of garbage. Vomiting was followed by defecation and urination.

Effects were transient and the dog recovered. This was reported to the late Dr. Henry Barbour, head of the Department of Pharmacology at Yale Medical School who suggested the procedure for an experiment, the results of which follow. The simple plan was carried out and since then lentin has been our main reliance for the quick treatment of suspected poisoning.

Doctor Barbour and the senior author used three dogs; one a 21-lb. Beagle, one a 60-lb. Coonhound, and the third a large mongrel weighing 92-lb. Each received three doses of 1:1000 lentin at weekly intervals and two hours after feeding. Results were noted. The outcome was the drawing of a tentative curve. Results from the three dogs indicated that the larger the dog, a lesser dose rate was required. Hence the curve was not straight, as will be noted.

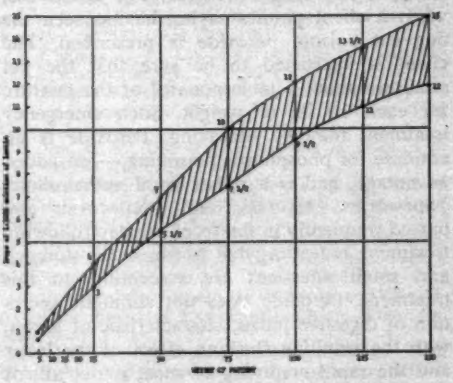
Next, the three dogs were tried with doses of the 1:10,000 solution giving ten times the dose of the 1:1000 in amounts which the curve indicated was optimum for that size dog. Poor reactions were observed and the 1:10,000 solution was thereafter abandoned. We concluded that the slower absorption of the larger, more dilute, dose produced a totally different reaction from that desired.

®Merck & Co., Rahway, N. J.

Standard dose was developed as drops (gtt.) per lb. basing the curve on that standard.

During the last ten years, when lentin was administered in the Whitney Veterinary Clinic, the dog or cat has been weighed in order to determine proper dose. In some cases, the weight was estimated and, after results were obtained, animals were weighed. Where the weight deviated from the curve, it was noted together with the results. In a few instances, too large doses were given without permanent harm. Overdose was evidenced by some prostration which passed quickly. Results indicate that the dose need not be exact, and that a few pounds one way or the other, in a large dog is inconsequential. For example, a 66-lb. Collie reacted well to 6 gtt. of lentin; a 90-lb. German Shepherd reacted to 8 gtt.; a 32-lb. overweight Cocker Spaniel was not harmed by 4 gtt.

Failures were rare. Of the several hundred doses used, only three have failed to produce emesis. These were in dogs which had consumed large doses of poison and were *in extremis*.



Successes produced some remarkable results. Two dogs which were seen to eat "Mole Knots" containing cyanide were saved with lentin. Many dogs known to have consumed "Ant Buttons", which contain phosphorus lived. One dog had eaten an entire grown skunk and not only reeked of the skunk odor but appeared intoxicated. This patient lost the skunk and intoxication quickly. Many dogs have been relieved of stomachs full of "tainted" garbage, much to their relief. One dog vomited two quarts of canned string beans.

Comparing the emetic properties of lentin with a 50% solution of 3% hydrogen peroxide in water, we find the latter produces emesis

as effectively and has the added advantage of producing a slime which lubricates so that metal objects, stockings, which are commonly swallowed, stones, glass chips, bottle tops, spark plugs, and other foreign objects pass up the esophagus easily.

The dose may be quite variable and still produce excellent results. Four ounces of the 50% solution, if the dog swallows it, will produce emesis in the largest dog; a tablespoonful in small dogs is sufficient to induce vomiting. When given by stomach tube dose used is approximately 1 oz. for each 25 lb. body weight. When clients attempt to give it by the lip-pocket method, the dog or cat usually swallows about half the amount prepared. Ivy found the 3% strength did not harm the stomach. We never have seen any harmful effects from giving it by mouth or stomach tube. Peroxide decomposes into water and oxygen, the 1½% solution releasing five times its volume of gas.

Many dogs and cats will fight the oral application of peroxide. Some patients will fight the passing of a stomach tube. In such cases, lentin is the drug of choice. For home use, when a client phones saying he has seen the dog eat poison, peroxide is prescribed. The client is instructed to be sure that the pet swallows about a tablespoonful of the mixture for each 10 lb. of weight. Such emergency treatment may be lifesaving. Peroxide is an antidote for phosphorus poisoning — an added advantage, and is a rather good anthelmintic. Tapeworms, ascarids, and hookworms are passed frequently in the feces the day following treatment, indicating that worms in the stomach and small intestines are susceptible to this treatment. Peroxide does not stimulate secretion of digestive juices, characteristic of lentin, with the resulting flushing effect of the latter and the rapid emptying of most if not all, of the alimentary tract. It is reasoned that the flushing tends to prevent absorption of toxins or poisons, since there is an outpouring of glandular secretions. Lentin in the 1:1000 solution, therefore appears to be a useful drug for the small animal practitioner.

Contraindications are: Weak hearts, kidney and liver disease, and general debility. However severely poisoned animals will surely die if untreated. No deaths have been attributed to lentin, although we have seen some cases of marked prostration in debilitated animals.

Conclusion

Lentin (1:1000) was used subcutaneously on three dogs of varying weights and a curve of optimum dosage prepared. Following the preparation of the curve, several hundred dogs have been dosed in practical use, with excellent results. Solutions of 1:10,000 produced inferior results, possibly because of the slower absorption. The optimum dose (1:1000) was determined to be 1 gtt. to 7 lb., for average size dogs. Small dogs required slightly more and the large less per pound than average sized dogs. Cats also were dosed, using 1 gtt. for the average 6-lb. cat and more for large cats.

The relative merits of lentin and hydrogen peroxide as emetics are discussed. The writers conclude that for emesis only, peroxide is superior of the two agents but for more thorough emptying of alimentary tract lentin is the drug of choice.

▼ ▼ ▼

Intestinal Trichomoniasis in a Dog

FRANK A. O'DONNELL, D.V.M., Louisburg, Kansas

In February of this year, the writer purchased a six-month-old female German Shepherd from an owner who stated that the dog had been on a diet composed entirely of raw horse meat and milk. He also said that the dog had been whelped and lived for a few weeks on a farm near Chicago, Illinois.

The dog was observed for a few days while arrangements were being made to care for her. A persistent diarrhea was noted during this period as was the roughened condition of the hair coat. Soft and copious stools were passed six to ten times daily. The dog exhibited thirst at all times, drinking about a gallon of water within a 24-hour period.

Fecal smear proved negative for parasitic ova. Believing that the dog was parasitized, however, further search, using zinc sulfate as a flotation agent, revealed the presence of a rather heavy infection of *Toxocara canis*. Treatment for this condition alleviated the diarrhea slightly for about two days; the feces then reassumed a rather fluid consistency.

Metamucil (Searle) added to the ration twice daily temporarily relieved symptoms. After ten days, the drug was discontinued and the diarrhea returned immediately.

A third fecal examination revealed the presence of great numbers of Trichomonads. Treatment was started at once using diodoquin (Searle) in the amount of 650 mg. three times daily. Within 48 hours, the feces had begun to assume a more normal consistency.

Fecal examination at the end of 15 days failed to reveal the presence of any appreciable number of parasites. An attempt was made to culture the organisms at this time using four parts of Locke's solution to one part of canine blood serum. Results were negative.

Condition of the hair coat improved and weight gains were normal. Attitude and general appearance of good health were evident prior to completion of scheduled treatment.

There are few reports of intestinal trichomoniasis in dogs. One case was reported in a female Collie puppy, seven weeks of age, by Bruce[1]. In this case, the condition was complicated by distemper and the patient subsequently died. Autopsy revealed a tightly coiled cecum containing numerous round, pinhead-sized lesions filled with clear, watery fluid.

In 1926, Kessel[2] reported cases of intestinal trichomoniasis in a litter of kittens in Peking. These animals developed diarrhea and died one week later. The Trichomonads, which resembled *Trichomonas hominis*, were cultured and transferred to other kittens by way of the mouth and anus. These animals also died. Other kittens were innoculated with Trichomonads from man, monkeys, and rats. Some of these developed diarrhea.

REFERENCES

1. Bruce, K. L., Trichomoniasis in a Puppy. *Vet. Med.*, 36:261, 1941.
2. Kessel, F. J., Trichomoniasis in Kittens. *Proc. Soc. Exp. Biol. & Med.*, 24:200, 1926.

▼ ▼ ▼

Chlorophyll Derivatives on Odors

(Continued from page 380)

new technic several workers have had rather consistent positive results at approximately the same dosage level.

For those who have worked with effective levels of chlorophyll derivatives, the results are clear cut and astounding. A bitch in full estrum can be taken anywhere with no nuisance from males, yet if left with a male, will breed.

Chlorophyll given to a bitch after attraction has begun cannot be expected to be effective until urine on the premises looses its attractiveness. It must be expected that many males, like our laboratory males, will learn to function without odor attractants.

When a standard method of assay of chlorophyll derivatives is accepted by producers, and practitioners develop a clear understanding of dosage levels necessary, many dog owners will be spared the "bitch in heat" nuisance.

Summary

Twenty-five bitches were treated with varying levels of chlorophyll derivatives during estrum, and then were tested with laboratory males and outside males to determine the effect on attraction odors.

Bitches given 4 mg. chlorophyll derivatives per kg. of body weight per day showed little, if any, attraction for males other than by direct flirting.

Bitches receiving less than 3 mg. chlorophyll derivatives per kg. body weight per day had normal odor attraction for males.

Chlorophyll in effective doses removed the attractiveness for males within 24 hours, and remained effective for more than 24 hours but less than 48 hours.

Chlorophyll was well received by most dogs.

REFERENCES

1. Serling, M. E., Control of Body and Breath Odors with Chlorophyll Fraction. *Vet. Med.*, 45:291 (July), 1950.
2. Fawcus, E. W., Use of Chlorophyllin in Dogs. *Vet. Rec.*, 64:632 (Oct. 18), 1952.
3. Worden, A. H., and Waterhouse, C. E., A Note on the Oral Administration of Chlorophyll to the Dog. *Vet. Rec.*, 64:573 (Sept. 27), 1952.
4. Chilman, G. F., Use of Chlorophyll in Small Animal Practice. *Vet. Rec.*, 64:282 (May 10), 1952.
5. Wright, R. G., Kohler, G. O., and Hoover, R. D., Use of Chlorophyll Preparation in Reducing Dog Odors. In press.
6. Joss, G. E., Use of Chlorophyllin in Dogs. *Vet. Rec.*, 64:631 (Oct. 18), 1952.
7. Burkhardt, B. S., and Philips, L. R., Control of Canine Estrual Odor with Chlorophyll. *Jour. Small Animal Med.*, 1:47, (Aug.), 1952.
8. Newberry, W. Edward, and Gier, H. T., Determination of Breeding Time in the Bitch from Vaginal Smears. *Vet. Med.*, 47:390 (Sept.), 1952.
9. Rubric of the Council on Pharmacy and Chemistry of the American Medical Association. *Jour. Am. Med. Assn.*, (May 5), 1951.
10. A.O.A.C. Spectophotometric Method for Total Chlorophyll and the A and B Components. Official and Tentative Methods of Analysis of the A.O.A.C. 1945, 6th ed., p. 141.
11. Munsch, J. C., Report to American Pharmaceutical Association quoted by Joss. 1952.

▼ ▼ ▼

One or two examples do not establish basis for sound generalization. Reasoning by example may lead to false conclusions unless enough facts are accumulated from which generalizations can be made.

▼ ▼ ▼

At least 10 women are among 1954 graduates in veterinary medicine.

Veterinary Fees for Rabies Vaccination

Veterinarians were amazed at the statement on the cover of *Dog World* for July 1954, which read, "35¢ Vaccine Cost Brings $3. Vet'n Fee."

Vigorous protests followed calling on editor, Will Judy, to make inquiry of reasons why material costs do not, in themselves, govern charges for veterinary service. Subsequently (*DW*—August 1954, p. 20) in an initialed editorial, Captain Judy explains to his readers why the veterinarian charges $3. for services which require the expenditure of 35¢ for material used. He notes that professional knowledge, time, investment in facilities and equipment, et cetera, must be considered when placing a value on professional fees. He drew analogy to his experience in law practice and cited a client's protest to a fee which he justified by knowledge and experience rather than material used.

Unqualified statements such as quoted above influence only those who fail to recognize or consider the many factors that determine fees for professional service. Nevertheless, they do irreparable harm and are unfortunate.

Dog World is the most influential and widely-read magazine for the dog owner and fancier. Its stated policy through the years has been toward better cooperation and understanding between the dog-owning public and veterinarians. It is anticipated that this policy will continue.

Preliminary report of a new pain-killing drug, known only as MRP-125, was presented at the recent A. M. A. convention in San Francisco. It is claimed that injection of this new agent relieves pain without loss of consciousness in the patient.

▼ ▼ ▼

Household Steel Kitchen Cabinet Assemblies Serve Small Animal Surgery Needs

Illustrated below is the specially constructed steel kitchen cabinet assembly recently installed in the surgery of the Crago Animal Hospital, Youngstown, Ohio.

The new counter and cabinet units occupy one full 12-foot wall of the operating room. They include two 15-inch cupboard cabinets, two 15-inch drawer cabinets, two 18-inch cabinets and a 48-inch double-bowl sliding, drainboard sink. Counter top is formica. Republic Steel Kitchens, Canton, Ohio, were designers and manufacturers.

A drawer feature especially designed for storage of fine silver serves the purpose for surgical instruments. Deeper drawers and cupboard are used for storage of sterile packs, cotton, towels, and like items used in this room. The entire base cabinet unit is well-suited to the purpose intended, is easily kept clean and free from odors, and affords ample and satisfactory storage space for normal complement of a small animal surgery.

Clinical Investigation Of Furazolidone In The Treatment Of Fowl Typhoid

A. S. COSGROVE,* D.V.M., Dover, Delaware

FOWL typhoid has been a disease of major economic importance in the poultry industry for many years. Poultry pathologists of the eastern United States report that the incidence of this disease has increased in most states during the past several years. It has been especially severe in some of the concentrated turkey- and broiler-producing areas.

Sulfonamides and antibiotics have been used in an attempt to control this condition. However, results obtained have been erratic and unpredictable. They were of little or no value in severe acute outbreaks when they were needed most. Many flocks had to be sold prematurely in order to salvage a part of the investment.

During the summer of 1953 a nitrofuran known as furoxone® (N-[5-nitro-2-furfurylidene]-3-amino-2-oxazolidone) was made available for experimental use in the field. This compound has been shown to be of value against fowl typhoid and turkey blackhead under laboratory conditions. For preliminary trials the suggested dosage was 100 gm. of furoxone per ton of mash for three days and then 50 gm. per ton until the outbreak was under control, or until the birds were sold. The dosage would need to be varied to determine optimum therapy.

Furoxone was used in a number of flocks in the Del-Mar-Va area. No portion of any of these flocks was maintained as untreated controls. Some of the results we have observed are as follows:

Flock 1. Fowl typhoid was diagnosed in a flock of 6,200 ten-week-old Beltsville White turkeys. The daily mortality prior to the diagnosis, was 15, 36, 38, 33, 42. At that time one of the sulfonamides was mixed in the feed at the rate of 2 lb. per ton. This was fed for five days and the following mortality was experienced: 38, 30, 32, 28, 30. Sulfonamide-medicated feed was withdrawn. Furoxone was then added to the basal ration at the rate of 100 gm. per ton and the daily mortality became 33, 28, 20, 9, 7, 1, 0, 1, 0, 0, 0. Medication was discontinued at this point and the daily losses were 0, 30, 28. The furoxone was started again and continued until the birds were sold at 26 weeks. The mortality from fowl typhoid dropped to zero and remained there. During the last six weeks, the turkeys received mash and furoxone in the morning and corn in the afternoon.

Flock 2. Fowl typhoid was recognized in a flock of 400 Broad Breasted Bronze turkeys, 18 weeks of age. The daily mortality prior to diagnosis was 2, 0, 2, 6, 8, 9. Furoxone medication *via* the feed at the 100 gm. level was started at that time and the losses recorded were as follows: 8, 2, 1, 0, 0, 0. After five days, the drug was reduced to a 50 gm. level and typhoid was not observed. However, during the last few weeks, before they were sold, the program of feeding corn in the afternoons was started and symptoms again appeared. The higher level (100 gm./ton) was used again and no further trouble was experienced.

Flock 3. Fowl typhoid was diagnosed in a flock of 5,000 BR x NH chicks, five weeks of age. Mortalities of up to 156 chicks per day were recorded. Medication with one of the sulfonamides lowered the mortality to 47 daily. After withdrawal of this agent, furoxone was added to the basal ration at the 100 gm. level per ton of mash. The medicated feed was fed and the losses were as follows: 46, 54, 54, 23, 19, 12, 6, 10, 4, 12,18, 3, 5, 3, and remained at 3 to 5 per day until sold. In this instance, the 100 gm. level was fed for two days and then a 50 gm. level for a like period. Since this did not bring about control as rapidly as desired, all were put on, and kept on, the higher level.

Flock 4. This was a flock of 665 pullets about six months of age. The outbreak was observed early, only seven birds having died in three days. Furoxone treatment, at the level of 100 gm. per ton of mash feed, was started immediately and no mortality from ty-

®Furoxone, brand of furazolidone, was supplied through the courtesy of Eaton Laboratories, Inc., Norwich, N. Y.

*Assistant Poultry Pathologist, Delaware State Board of Agriculture.

phoid was observed after 48 hours. This flock was sold about three weeks later.

Flock 5. Fowl typhoid was diagnosed in a flock of 4,000 12-week-old BR x NH broilers. This flock also was affected with chronic respiratory disease. Prior to the high level (100 gm./ton) furoxone therapy, the daily losses were 31, 63, 100. On the day treatment was started, the mortality had increased to 145 birds. By the sixth day of medication mortality had decreased to 15 birds. The daily losses for the six days were as follows: 145, 165, 81, 41, 26, 15. The chickens then were sold.

Flock 6. Fowl typhoid was first observed in this flock of 1,100 13-week-old Broad Breasted Bronze turkeys. Losses were two to three birds daily. A treatment of 100 gm. of furoxone per ton of feed was used for two days. The drug level was then reduced to 50 gm. per ton and continued until the birds were sold. No losses were reported after the first three days of medication.

Flock 7. Limited work has been completed to determine what effect, if any, furoxone has in laying flocks on subsequent agglutination titers. Fowl typhoid was diagnosed in a laying flock of 1,200 birds. The mortality was 10 to 15 birds a day. The birds were put on 100 gm. of furoxone per ton of feed. In addition to this, 16 of the most severely affected birds were banded and given 100 mg. of furoxone in tablet form, twice a day for three days. Of this number, three birds died the day following initial treatment. The remaining 13 birds were blood tested following the initial treatment. Of this group, 12 showed strongly positive agglutination titers to a pullorum antigen. Three eggs from this flock were cultured and no bacteria were isolated.

The above listed cases are uncontrolled outbreaks in which it was not possible to maintain untreated pens of birds. Neither was it possible to examine or culture every bird that died. In all flocks the infected birds were kept on the same contaminated litter and ground after treatment was started. Moving, cleaning, and disinfecting would have been impossible or impractical.

At this point it appears that the turkey and broiler growers now have available another chemotherapeutic agent that will permit them to rear their flocks to a marketable age without suffering uncontrolled mortality from fowl typhoid. The recommended procedure at this time would be to use furoxone at the 100 gm. level per ton of feed for two weeks to control the outbreak and then change to the 50 gm. level until the birds are sold.

Summary

The addition of the antibacterial nitrofuran, furoxone, to the feed reduced mortality and controlled outbreaks of fowl typhoid in three flocks of turkeys and four flocks of chickens under field conditions.

The use of furoxone in fowl typhoid outbreaks makes it possible to rear affected poultry flocks to a marketable age without suffering uncontrolled mortality.

▼ ▼ ▼

Veterinarians Needed as Poultry Inspectors

The Poultry Inspection Section of the USDA is in need of qualified, graduate veterinarians to fill vacancies.

Entrance salary is $4,205. to $5,060. per annum based upon a 40 hour, five-day work week. No written examination is required. Appointments are made on the basis of applications submitted.

For further particulars address: United States Department of Agriculture, Agricultural Marketing Service, Poultry Inspection Section, Washington 25, D. C.

▼ ▼ ▼

Exhibit Purebred Swine from Quarantined Area

California has amended quarantine restrictions imposed in certain counties and areas, because of the incidence of vesicular exanthema, to allow breeders of purebred swine, not garbage fed, to exhibit and offer such swine for sale. Permits will be issued on request after official inspection of premises.

Investigation has revealed during the past 22 years that vesicular exanthema has existed in hogs in California; it has been confined almost entirely to swine fed raw garbage, and never has been a problem in grain-fed, purebred animals.

▼ ▼ ▼

Referring to farm crop surpluses as revealed by inventory of the Commodity Credit Corporation on May 12, 1954, "your share of food and fiber in the 'cellar' cost $19.38." In the light of supply per capita, government surpluses may be justifiable strategic reserve. — *Successful Farming.*

EDITORIAL COMMENTS

Staggering Losses Due to Livestock Diseases

A recently issued, paper-bound book entitled, Losses in Agriculture, prepared by the Agricultural Research Service, USDA, contains a chapter of 32 pages devoted to mortality and morbidity statistics of American livestock and poultry. This material explains how estimates were made and what they include. With accompanying tables there is portrayed the staggering losses growers suffer annually due to ravages of disease and parasites.

An effort has been made to include estimates of annual livestock losses at the farm level, from all causes, for the period 1942-1951, with separate estimates for disease-control costs. Accuracy of estimates of morbidity losses may be challenged but are believed to be conservative. They encompass loss of milk, eggs, wool, meat, hides, work days for horses, loss of feed consumed, labor for care and handling, loss of offspring, and replacement cost. Not included is cost due to owner inconveniences and expenditures for care. For some (virus diseases) loss estimates are not included in tables since information of incidence, mortality, and morbidity are fragmentary or not available. Difficulty in diagnosis and relative insidiousness of some pathological processes influence accurate estimates of losses attributable to many diseases suggestive of either virus, bacterial, or fungus etiology.

A large number of noninfectious diseases of livestock, particularly cattle, result in deaths, reduced gains, failure to grow, and the need for veterinary attention. Reports from veterinarians reveal that 70% of calls to treat or advise on animal diseases were for those accepted as noninfectious. Morbid processes falling in this category are not reportable anywhere, except as they may affect the carcass acceptance for food when the animal is slaughtered. No reports are available on the number that sicken and die from these causes. Figures on losses due to these metabolic or nutritional disorders would swell measurably reported morbidity and mortality statistics if they were added.

Average annual loss due to a selected group of diseases are given as follows:

Leptospirosis—	Cattle	$100,000,000.	
Anthrax—	Cattle	$104,000.	
	Horses	$ 4,000.	
	Swine	$ 9,000.	
	Sheep	$ 1,000.	
		Total	$118,000.
Brucellosis—	Cattle	$87,000,000.	
	Control cost	$14,000,000.	
	Sterility	$59,000,000.	
		Total	$160,000,000.
(Does not include swine, goats, man)			
Erysipilas—	Swine	$ 24,000,000.	
Johne's Disease—	Cattle	$ 194,000.	
Mastitis—	Cattle	$225,000,000.	
(Cost of treatment, drugs, and veterinary service not included)			
Leucosis—	Poultry	$240,000,000.	
All management losses—	Baby pigs	$438,573,000.	
Nutritional Deficiencies—	Poultry	$ 12,000,000.	

QUESTION BOX

1. What general factors influence physiological response to hormone therapy? See page 361.

? ? ?

2. What symptoms characterize rabies in cows? See page 366.

? ? ?

3. What is the effect of bovine hyperkeratosis on reproductive ability? See page 371.

? ? ?

4. What new product gives promise for reduction of losses due to fowl typhoid? See page 393.

? ? ?

5. What dollar figure is given for annual losses to American livestock due to disease and parasites? See page 395.

? ? ?

6. Where does the United States rank with other nations in incidence of bovine tuberculosis? See page 400.

? ? ?

7. What is the effective level of chlorophyll in suppressing mating odors in bitches? See page 377.

? ? ?

8. Compare emetic properties of two common agents. See page 389.

? ? ?

Parasitic Diseases

Approximately 300 species of internal parasites are of economic importance to the livestock industry of the United States. Losses, though occurring in all age groups, are heaviest in young stock, chicks, and poults.

Morbidity losses taken into account include: (1) Reduced yield, (2) condemnation of parts of, or whole, carcasses, (3) waste of feed, labor, and space, (4) interference with breeding and reproduction, (5) reduced quality of products, (6) lowered efficiency of work animals, (7) depreciation of capital items, (8) inefficient utilization of facilities, (9) lowered resistance, (10) human health aspects, and (11) money spent on nostrums. In addition, control costs or charges ascribable to protection against parasites include: (1) Expenditures for drugs for treatment, control, eradication; (2) cost of veterinary service; (3) expenditures to prevent introduction and spread; (4) expenditures for research; and (5) cost of regulatory services.

This list, though comprehensive, does not cover all manner in which losses due to parasites may be sustained. It emphasizes the ramification of loss and the difficulty or impossibility of assessing accurate estimates.

Annual loss due to a selected group of parasites are given as follows:

Grubs	Cattle	$100,000,000.
Lice	Cattle	$ 20,000,000.
	Swine	$ 3,100,000.
	Goats	$ 800,000.
	Poultry	$ 80,000,000.
Ticks	Cattle	$ 13,800,000.
Screw worms (Exclusive of treatment cost—personnel and drugs)	Cattle	$ 20,000,000.
Horn Flies	Beef Cattle	$100,000,000.
	Dairy Cattle (milk production)	$ 50,000,000.
Stable Flies		$20,000,000.
Horseflies		$ 75,000,000.

In summary, livestock losses due to disease and parasites is estimated at $2,688,000,000. annually, about $1,882,000,000. of which may be considered as loss of cropland products. That is, the potential return from 19,859,000 acres of cropland was lost because of disease, insect pests, and internal parasites of livestock, and the market downgrading of products derived due to quality deterioration.

What percentage of these losses are preventable? Certainly no small share could be saved if good management practices always are used and the present advanced knowledge of disease control and treatment applied properly.

The facts in this report further emphasize the truths in the oft-repeated statement made on these pages, that disease and parasites are the primary limiting factors in profitable livestock production. They also point up the tremendous potential for service to the industry by veterinarians.

▼ ▼ ▼

First Lieutenant Bill Signed by the President

Senate bill S-932 passed both houses of Congress and was signed by President Eisenhower, becoming law July 1, 1954. This legislation, referred to as the First Lieutenant Bill, grants a first lieutenant grade to veterinarians accepted into the Army Veterinary Corps.

Opponents and supporters of S-932 never were in large majority so that final action was not certain until final passage. Strong support given the legislation by officials of the A.V.M.A. contributed to successful enactment that corrects a prejudicial situation that has existed for several years.

▼ ▼ ▼

M Vaccine Fails in Wisconsin Test

Most extensive trials so far conducted to test the efficacy of Brucella M vaccine confirms previous results reported. Challenge of animals 16 months after vaccination as calves or breeding-age heifers revealed 73% infection on light exposure and 100% infection after heavy challenge doses. Many of each group aborted. Figures were slightly higher for the M vaccinated that for unvaccinated controls.

In summary, the Wisconsin researchers believe that these tests prove conclusively that M vaccine has little or no value as an immunizagent.

Interesting in connection with these experiments is the fact stated that 35% of these animals vaccinated with stain 19 vaccine were infected by challenge exposure via conjunctiva and all aborted. Ten of 11 infected animals of 17 vaccinated with strain 19 aborted following exposure to massive doses of live culture for an infection percentage of 65%.

▼ ▼ ▼

Slime in water fountains is often associated with leg paralysis in fowls.—*R. H. Leonard, D.V.M.*

Brief History of Ornithosis "Psittacosis" With Particular Reference to Outbreaks in Poultry Plant Employees

A case of possible barnyard ornithosis in a farmer was the source of infection for seven relatives in a rural community near Malone, Texas in 1937-1938; five of the eight illnesses proved fatal.

Five outbreaks of psittacosis with at least 96 cases and 7 deaths occurred in employees of poultry dressing establishments at Giddings and El Campo, Texas in 1948, 1951, 1952 and 1953. The majority of the cases and all of the deaths occurred in negroes. All cases had been dressing turkeys for the Thanksgiving or Christmas market, or at the end of the egg-laying season. The illnesses varied in severity from minor influenza-like attacks to severe toxemias terminating fatally. The majority of cases examined showed *x*-ray evidence of pneumonitis or atypical pneumonia. The use of broad spectrum antibiotics (aureomycin, terramycin, and chloromycetin) appeared to be beneficial. Relapses occurred frequently both in treated and untreated cases. The complement fixation test was used extensively either with psittacosis or lymphogranuloma venereum (LGV) antigen as an aid in the identification of the disease. All attempts to recover the virus from the cases failed. A very toxic psittacosis virus was recovered from the flock of turkeys which was responsible for the second outbreak at Giddings.

A severe case of psittacosis apparently was the result of eviscerating chickens in an establishment at Fairbury, Nebraska in September 1952.

In April, May, June, and July 1954, outbreaks of psittacosis occurred in employees of poultry plants at Corsicana, Comanche, Lampasas, Brady, Taylor and Austin, Texas. About 200 persons have been ill but there has been only one death. All of those ill had been working where turkeys were dressed. Scattered cases of psittacosis occurred during this period in poultry workers in Fort Worth and San Antonio. A toxic psittacosis virus was recovered from turkeys both in the plants and on the farms on several occasions.—*J.V. Irons, Sc. D.*

▼ ▼ ▼

Of 34,401 swine blood tested for brucellosis in Illinois in 1953, 1,843 or 5.4% were shown to be reactors. Numbers and rates of reactors were less in 1953 than for 1952, although fewer animals were tested.

Rations and Meat Quality

Research on the effect of antibiotics on meat quality was reported by Prof. Ray L. Shirley of the University of Florida Experiment Station. This work, the first reported on the subject, suggests that the protein value of pork is regulated by biochemical processes in the animal tissue during life which involves both amount and quality of protein and mineral element provided in the ration. Meat protein value is directly proportional to the protein quality of rations. Antibiotics changed meat (ham) composition only in those cases where pigs were supplied low protein diets.

▼ ▼ ▼

Stiffen California Regulations Pertaining to Vesicular Exanthema

Action by the California Department of Agriculture, through an official order and amendment filed with the Secretary of State, requires that garbage fed to swine in California after October 1, 1954, must be cooked to destroy disease-carrying virus in order to qualify swine to be moved for slaughter or other purposes. To qualify, garbage feeders must have had an effective cooking operation in use for at least 30 days before quarantine is lifted. All restrictions will be removed from feeders who qualify under provisions of the new admendment. Detailed inspection will continue in all counties where garbage is fed to determine presence of disease and adequacy of sterilization procedures.

▼ ▼ ▼

Blood-Free Heart Surgery

University of Minnesota surgeons have been able to work in a blood-free field within the human heart for periods as long as 27½ minutes without damage to either patient or donor, according to the *Bulletin for Medical Research.*

The new technic, developed through six years of research on dogs, is controlled, cross-circulation of blood between patient and donor. The method involves tieing off the patient's heart at the vena cava. Then the patient's lungs are collapsed while a mechanical pump circulates blood from the donor's femoral artery, while carrying to the donor an equal amount of venous blood for purification and oxygenation. By these means, circulation of patient and donor become one system, making direct vision possible for successful interventricular repairs.

PRINCIPLES OF ANIMAL HEALTH

R. R. DYKSTRA, D.V.M.
Manhattan, Kansas

Semen Collection by Electrical Shock

In England research is continuing in the matter of electrical semen ejaculation in aged and lame animals, and in cases of those which refuse to discharge into an artificial vagina. An apparatus devised by Rowson and Murdock, as described in the June 5, 1954 issue of *The Veterinary Record*, consists of electrodes in the form of rings, worn on the fingers (the latter rubber gloved) and introduced into the animal's rectum so that the two fingers carrying the copper ring electrodes are placed over each side of the ampulla. The electric current passes through a small transformer of low voltage (24 V. according to the report) and a rheostat controlling the current to the electrodes. Seminal fluid is first produced, followed by semen that is usually in considerable volume and of good quality, as attested by the fact that 86 first inseminations carried out with semen obtained in this way gave a 70%, 90 to 120-day conception rate. The semen is collected in a warmed funnel and test tube. There is practically no systemic reaction, so additional restraint of the animal seldom is necessary.

▼ ▼ ▼

Vaccination by Atomizer

An article in the *USDA Employee News Bulletin* of June 16, 1954 contains an article entitled, Vaccination by Atomizer, in which it is stated that small fur animals as well as chickens can be immunized against virus diseases by spraying live virus into the air around the animals by means of an atomizer so that fine droplets of the atomized live virus are inhaled into the lungs. Specific antibodies are alleged to be produced so that an immunity is established. Ferrets and minks have been thus handled for the control of distemper, and fowl for Newcastle disease and bronchitis. There probably are details and safeguards in this attempted method of immunization that are unknown at this time to the writer of this paragraph, but we would be apprehensive in resorting to it especially since our conception of at least one method or means by which viral diseases may be spread is by inhalation of contaminated air, and since in the past we have attempted to prevent the spread of many of these ailments by air fumigation with formaldehyde and others, and segregation and disinfection of the premises, we shall watch with interest the steps and protective measures that are used in atomizer vaccination.

▼ ▼ ▼

Differentiation of Normal and Cancer Cells

An unusually well informed layman asked about the features distinguishing a cancer cell from a normal cell. Not being specifically informed, we had to go back mentally to our student days in pathology. We recalled that the cytoplasm of the cancer cell is comparatively scant, and that the nucleus is larger with more than the usual amount of chromatin. We have since learned that ultra-thin sections of cancer tissue, viewed under the electron microscope, seem to indicate that changes in the structure of the cytoplasm are of importance in differentiating between normal and cancer cells. The rather frequent appearance and observation, and the great significance, of mitotic figures in cancerous tissue was part of the information imparted to our lay inquirer. Many of the readers of this item undoubtedly would have been better versed, and therefore more informative, about the pathology of the cancer cell, its invasiveness, and tendency to reproduce itself.

▼ ▼ ▼

A question was submitted a few days ago concerning value of detergents (soap substitutes) in limited quantities in the feed of poultry and pigs, so that more and quicker economical gains would result in the animals so fed. We had to admit lack of additional knowledge beyond that advanced in 1950 by an experiment station nutritionist that detergents in feed had effect comparable to that exerted by the addition of some of the antibiotics. Theories then advanced were: (1) That the detergent decreased surface tension of the feed so that nutriments were more readily absorbed from the digestive tract, and (2) that because of decreased surface tension, growth of microorganisms in the digestive tract was effected.

POULTRY PRACTICE PROBLEMS

W. R. HINSHAW, D.V.M., Ph.D.
Frederick, Maryland

Physiology of the Ear of Birds

The structure of the ear of birds is essentially that of reptiles. It contains an inner ear, a middle ear, and an external auditory meatus, but no pinna like that of man. According to Sturkie (Avian Physiology), the range of sounds of different frequencies which are audible vary with species, with an upper limit of about 10,000 cycles per second for most birds. Exceptions are starlings which have a range of from 700 to 15,000 and parrots which have range from 40 to 14,000. Other examples of ranges are: English sparrow, 675 to 11,000; horned owl, 60 to 7,000; canary 1,000 to 10,000; and horned lark, 350 to 7,600. These frequencies compare with 16,000 to 20,000 for man; an upper limit of 35,000 for the dog; 50,000, the upper limit of the cat; and 98,000, the upper limit of the bat.

▼ ▼ ▼

Coccidiostatic Drugs for Turkey Coccidiosis

Boyer and Brown (Proc. Book, A.V.M.A., 1953, p. 328) reviewed the research which had been done on coccidiostats against turkey coccidia to that date and reported their own results on the comparative activity of seven drugs against the seven known species . Of drugs tried by them only two, sulfamerzine, and acetylsulfaquinoxaline were effective in preventing mortality. Both of these gave complete protection against all of the pathogenic species which caused significant mortality in the infected non-medicated controls. The drugs which were ineffective were nitrophenide, 2-amino-5-nitrothiazole, sulfioxazole, nitrofurazone and furoxone.

Chemotherapeutic agents were used against "pure" cultures of the species of coccidia. The species used were *Eimeria adenoeides, E. gallopavonis, E. meleagridis, E. innocua, E. subrotunda, E. dispersa* and *E. meleagrimitis.* All drugs were mixed in feed or drinking water according to the directions of the manufacturer. Sulfamerazine was used at 1:1000 and 1:2000 levels in drinking water and the acetylsulfaquinoxaline at 0.0175 and 0.05% levels in the feed. Treatments were started 44 to 72 hours before the birds were given coccidia and was continued for 14 days.

The studies by Boyer and Brown indicate that all of the pathogenic species of turkey coccidia can be controlled if treatment is given early and drugs used according to the specific recommendations of the manufacturer. Management plays an important role in the prevention and control and efficacy of any drug is dependent on the care with which a sanitation plan is followed. The reader is referred to the original article for details on drugs used by other investigators.

▼ ▼ ▼

Body Temperature of Birds

The average normal body temperature (rectal) of some of the common birds given below are quoted from Sturkie (Avian Physiology, Comstock Pub. Assoc., Ithaca, N. Y., p. 118, 1954). Temperatures are expressed as degrees Fahrenheit.

Chicken	106.2 — 106.5
Turkey	105.4
Duck	106.0
Goose	105.0
Quail	111.2
Pigeon	105.0 — 108.4
Eastern mourning dove	108.8
Eastern crow	106.0
Eastern robin	109.0
Humming bird	108.0
Eastern house wren	108.6
Crested flycatcher	111.4

▼ ▼ ▼

Dr. J. A. Harper, Oregon State College, advises that one square foot of floor space per poult be provided for floor brooding (*Oregon's Agri. Progress,* Winter, 1954). Doctor Harper found that in brooder houses with solid floors, type of heat did not affect growth rate, livability, feathering, or brooding costs. Floor space did, however have an effect on these factors. After eight weeks of brooding with one square foot of space, poults gained 3.6 lb., in contrast to 3.4 and 3.2 lb. when ¾ and ½ square foot, respectively, were furnished.

PUBLIC HEALTH

JAMES H. STEELE, D.V.M., M.P.H.
Atlanta, Georgia

Tuberculosis

Alaska has a very high prevalence of bone and extrapulmonary tuberculosis. Williams[6] in a study of 150 cases of which 74 were bone and extrapulmonary, and the remaining 76 pulmonary, isolated only *Mycobacterium tuberculosis* of the human type. He was not able to isolate any *M. tuberculosis* of the bovine type. Fourteen of the extrapulmonary cases were less than five years of age. Thirty-nine were between five and 16 years of age and 21 were 16 years and over. If bovine tuberculosis had been present, one would certainly expect it to appear in these young age groups.

During the period 1941-48, on the average of 1,000 cows were tested annually for tuberculin reactors. In no year were more than seven reactors found. The percentage of reactors read would not exceed 0.5%. In recent years no reactors have been found. For the period 1917-42 the percentage of reactors read was 1.6%.

Williams, in a survey of the cause of human tuberculosis in other countries, found that Germany, Australia, Switzerland, Scotland, Poland, and Netherlands had the highest incidence of bovine tuberculosis in man, ranging from 6 to 14% of the total number of human tuberculosis cases reported.

During the past five years only four cases of human tuberculosis of the bovine type have been reported in the United States. One of these was a lung infection. This person was a war refugee and probably became infected before entering the U. S. Another of these cases was a housewife who had lived in a large city for the past 20 years but previous to that had lived on a farm where tuberculous cattle had been housed or kept. Another case was a housewife who had lived in a large city in northeastern United States all her life. The last case was found in a man who was hospitalized for cancer and was found to have a concurrent tuberculosis infection. This person lived in Maine and had spent considerable time in Quebec.

Human tuberculosis is dropping rapidly in nearly all parts of the world. Unfortunately the same cannot be said for animal tuberculosis because it has received little attention except in North America, Scandinavia, and more recently United Kingdom, Holland, Germany, and parts of France. The United States is fortunate to have one of the lowest incidences of this disease in the world (Finland and Norway are the only countries with a lower rate) but it will require constant surveillance by veterinary officials and practitioners to maintain and lower present rate.

▼ ▼ ▼

Anthrax

The isolation of *Bacillus anthracis* from bone meal, suspected source of infection in the 1952 anthrax outbreak among swine in Ohio, is reported by Croft and Stegmiller[1]. They were able to isolate anthrax bacilli from six of 11 suspected bone meal samples by mouse inoculation. No anthrax bacilli were isolated from 27 other samples which were not directly suspected. They point out that it is difficult to isolate *B. anthracis* by culture, even when bone meal is known to contain spores. The antagonistic action of other bacteria on *B. anthracis* has long been known. The authors confirmed this point in their study.

A recent report from Great Britain,[2] presents further data on dried bones, bone products, and horn as sources of human infection. Between 1947 and 1952, 14 cases occurred in a chemical factory handling sun-dried, crushed bones from India and Pakistan. The crushed bones, which vary in size from 0.5 cm. (¼ inch) to 5 cm. (2 inches), are imported in canvas sacks, each holding about 150 lb. Cases of anthrax occurred among workers whose duty it was to sack the bones or otherwise handle the sacks. One of the 14 cases was in a man who visited the plant to remove empty sacks in his truck; the remaining 13 were among the factory employees handling the ground bone and sacks.

The laboratory examined 30 samples of bone, three of dust, four of sacking, and two of dried sinew from the plant. *B. anthracis*

(*Continued on page 404*)

[6]Williams, Ralph, Chief, Laboratory Branch, Alaska Department of Health, unpublished data.

[1]Croft, C. C., and Stegmiller, H. W., The Isolation of *Bacillus anthracis* from Bone Meal. The Public Health Laboratory, 10:5 (Sept.), 1952.

[2]Davies, D. G., and Harvey, R. W. S., Dried Bones as a Source of Anthrax. *Lancet*, 2:880 (Oct. 24), 1953.

CLINICAL REPORTS

Luxation of the Patella†

JAMES E. CARVER, D.V.M., Michigan City, Indiana

Luxation of the patella occurs most frequently in short-nosed breeds such as Pekingese, Boston Terriers, English Toy Spaniels. It also occurs less frequently in Boxers and English Bull dogs.

Medial luxation is most common; however, instances of lateral luxation are seen occasionally. When medial luxation occurs, the lateral ligamentous structures fail and the patella rides the medial condyle of the femur, usually resulting in "locking" spasms of the quadriceps muscle and pain. If allowed to continue the lower portion of the leg and foot will rotate medially and, in many cases, complete loss of use of the leg will result.

When lateral luxation occurs, the patella will be lodged upon or lateral to the lateral condyle of the femur. The lower portion of the leg would then rotate laterally. In either case the result is pain and lameness.

Etiology is genetic. In a few cases, injury may be a factor, but records and observations covering seven years indicate inheritant predisposition.

Diagnosis

It is seldom difficult to establish a diagnosis by palpatation. By holding the stifle joint in the palm of the hand and flexing the extending leg, it is often possible to feel the patella luxate and replace itself. In other cases, the patella can be palpated easily in its luxated position. Radiography will often establish a diagnosis.

Treatment

There have been many operations described to correct this condition. Most of them have consisted of, in one way or another, suturing the ruptured ligament back to the patella or making a new one, thus drawing the patella back into its normal position. These procedures have not proved satisfactory in our practice.

Our method of treatment is to remove the patella in the simplest fashion. The patient should be completely anesthetized. The area is clipped and prepared for surgery. Incise the skin over the medial line of the patella, regardless of its location, and dissect it carefully away from adjacent tissue. An alternate procedure is simply incising tissues around the bone, and then lifting the patella out with a pair of bone forceps. Results with either method are comparable. The skin should be sutured with any good material, such as cotton, nylon, et cetera; interrupted type is preferred.

The animal should receive one injection of penicillin and be placed in a cage for about six days to rest. In some instances a little blood and synovial fluid will accumulate at the operative site. This can be expressed whenever necessary until no more accumulates. If hemorrhage occurs in the area, a compression bandage may be applied for about 24 hours. At the end of the seventh to tenth day, many patients will start to use the leg, and by the end of four to five weeks there should be no evidence of pain or little, if any, lameness. Apparent complete recovery is the rule.

†Presented at the 70th annual meeting of the Indiana Veterinary Medical Association, Indianapolis, Jan. 13-15, 1954.

▼ ▼ ▼

Mercury Poisoning in a Dairy Herd

WILLIAM W. HERBERG, D.V.M.,
New Richmond, Wisconsin

Mercury in small amounts is toxic to cattle. On April 17, 1954, 14 oz. of a commercial seed disinfectant* was applied by the "dry method" to 30 bu. of oats in a wide-type wagon box. After seeding, the wagon box was swept "clean". Oats was ground into this wagon box the same day and scooped into a feed bin adjacent to the barn. That evening each cow in a 16-cow string received approximately one gallon of ground oats in addition to corn, supplement, and alfalfa. The next morning, the first cow, a registered Holstein, was off feed, stood with an arched back, and exhibited symptoms of rumen atony. Temperature was subnormal. Magnesium sulphate (1½ lb.) was administered by means of a drench. Salivation increased and the heart beat was fast with irregular respirations. Concentrated rumovac,® stomachic and rumenatoric was given 30 minutes later, after which the animal collapsed and showed evidence of much colicy pain. A blood sample was taken which appeared to be dark and had the viscosity of glycerine. Body and extremities remained cold one hour after poisoning and death occurred four hours later.

®Norden Laboratories, Lincoln, Nebraska.

*Ceresan M — E. I. DuPont de Nemours & Co., Inc., Wilmington, Del.

The second cow, a purebred Holstein, exhibited identical symptoms and was given the same treatment as the first. This animal also died.

Five other cows in the herd exhibited slight symptoms of rumen atony, salivation, and decreased milk flow. These five cows were back to normal two milkings later after treatment with 30 cc. of a 20% solution of sodium thiosulfate given intravenously.

Portmortem examination revealed hemorrhagic enteritis and a marked nephritis. There were no other outstanding lesions.

Death was due to shock and exhaustion. Laboratory reported the presence of mercury in a ground oats sample tested.

▼ ▼ ▼

Bee Stings Responsible for Death of Goslings

DENNIS E. CUMRO, D.V.M., Hallenberg, Kansas

On June 30, 1953, I was called to perform autopsy on eight young geese three to four weeks of age, which suddenly sickened and died. The farmer was suspicious of moldy feed and reported that prior to an hour before death the goslings had taken food as usual, which consisted of prepared chick mash, moistened with milk shortly before feeding. The mash, which was purchased earlier in the day, appeared normal with no musty or moldy odors.

Three goslings were lying dead directly in front of a bee hive which was placed in the corner of the lot, and five others were scattered around a low-type, tin, water trough, where numerous bees were gathered. Seven of eight birds examined revealed swellings of the hard palate, pharynx and edema of the glottis. In the region of the pharynx in each bird was a circumscribed, pale area approximately five millimeters in diameter, with a black, foreign body in the center which proved to be a bee sting (odor of ripe bananas). The average length of the sting was three millimeters, and the musculature surrounding the glandular portion of one of these still showed motility, which tends to show that death occurred rapidly.

In such cases, it is not always the direct toxic effect of the venom which causes the trouble, but more often the mechanical obstruction of the air passages and resulting suffocation. There is little one can do in these cases, because of the rapidity of the course of events, but in the more or less chronic cases, removal of the stinger, drainage of the fluid which collects between the hard palate and the bone forming the roof of the mouth offers great relief and enables the goose to close its mouth and take food. This condition is seldom, if ever, observed in adults.

▼ ▼ ▼

Less Than 1% Brucella Reactors in Oregon

Operating under a consistent, well coordinated program conducted by the State Department of Agriculture, the Federal Bureau of Animal Industry and the Oregon State College Extension Service, incidence of brucellosis reactors has been reduced in that state.

There were 289,743 cows tested in 1953, according to H. P. Ewalt, dairy specialist, as compared with 246,437 in 1948. During this six-year period reactors have declined from 1.68 to 0.778%.

▼ ▼ ▼

Rabies of Cattle

(*Continued from page 370*)

groups, 13 of the 17 head, or 76.52%, died within the period of 20 to 30 days.

The five animals which died in the vaccinated group were positive by microscopic examination of the brain and mouse inoculation of the brain and salivary gland tissues.

In the nonvaccinated control group, one animal, no. 3381, was negative by microscopic examination of the brain but positive by mouse inoculation of both brain and salivary gland tissue. The remainder were positive by all three procedures.

REFERENCES

1. Starr, L. E., and Stafford, A. L., Progress Report on Avianized Anti-Rabies Vaccination Project. Proceedings Fifty-Third annual meeting U. S. Livestock Sanitary Association.

2. Koprowski, H. and Cox, H. R., Studies on Chick-Embryo Adapted Rabies Virus, I. Culture Characteristics and Pathogenicity. *Jour. Immunol*, 60:533, 1948.

3. Koprowski, H., and Black, J., Studies on Chick-Embryo-Adapted Rabies Virus, II. Pathogenicity for Dogs and Use of Egg-Adapted Strains for Vaccination Purposes. *Jour. Immunol*, 64:185, 1950.

4. Schroeder, C. R., Black, J., Burkhart, R. L., and Koprowski, H. Rabies in Cattle, I. Prevention of Vampire Bat Paralytic Rabies, Derriengue, by Vaccination With Chick-Embryo-Adapted Rabies Virus. *Vet. Med.*, 47:503 (Dec.), 1952.

5. Koprowski, H., Black., J., and Nelsen, D. J., Studies on Chick-Embryo-Adapted Rabies Virus, VI. Further Changes in Pathogenic Properties Following Prolonged Cultivation in the Developing Chick Embryo. *Jour. Immunol.*, 72:94, 1954.

BOOK REVIEWS

Books reviewed in this department and any other books, if available, may be obtained by remitting the published price to the Book Department, Veterinary Medicine, Suite 803 Livestock Exchange Building, Kansas City 2, Missouri.

VETERINARY NECROPSY PROCEDURES, edited by *Thomas C. Jones, Lt. Col., V. C., U. S. A.*, and *Chester A. Gleiser, Lt. Col., V. C., U. S. A.*. Publication sponsored by the Armed Forces Institute of Pathology and The American Veterinary Medical Association, 136 pages, 50 illustrations. J. B. Lippincott Co., Philadelphia, publishers, Price—$7.50.

This book is a compilation of monographs by 13 authors, each contributing a section or chapter. Editors, as noted above, have arranged material carefully so that essentially no duplication appears, and continuity is retained.

Following a brief discussion on the importance of necropsy by Dr. E. A. Benbrook and a more detailed one regarding the general principals involved by Dr. Hilton Smith, there follows a succession of chapters outlining preferred necropsy procedures for horses, cattle, and sheep, swine, dogs and cats, chickens and other birds, laboratory animals, and wild animals.

These are essentially step-by-step directions dealing with positioning, incisions, and recommended chronology for examining various systems and body organs expressed in simple and precise fashion. Accompanying illustrations (drawings) are clear, showing preferred exposure methods.

The senior editor is author of the chapter having to do with preparation of protocols. Here is emphasized the value of standardized guide forms and descriptive writing.

The prosector, states this author, must be provided with recorded history and results of clinical study and treatment. It is difficult, if not impossible, to establish a diagnosis having nothing more at hand than a carcass. In reference to writing a necropsy report, Lt. Col. T. C. Jones points out that it should be objective, and describe clearly what is observed in each organ and tissue examined. The writer must guard against using the name of the lesion instead of describing its characteristics.

Today none will question the value of necropsy as a method of establishing a positive diagnosis, nor the importance to disease control in animals of a more complete understanding of morbid processes. These are learned through continuous study and observation, which is certain to improve diagnostic acumen of those who take advantage of every opportunity to make full use of necropsy.

▼ ▼ ▼

SURGICAL PRINCIPLES AND TECHNICS by *W. F. Guard*, D.V.M., Chairman, Department of Veterinary Surgery, The Ohio State University, Columbus, 243 pages, 283 illustrations, 2nd ed. Edward Brothers, Inc., Ann Arbor, Michigan, publishers, 1953.—Price $7.50.

In the review (*Vet. Med.*, 46:375 [Sept.], 1951) of the first edition of this work it was stated that, "... the author has been mindful of the difficulties under which veterinary surgery is ordinarily performed, inexperience of assistants usually available, and other limitations for performance by standard methods with which practitioners are familiar." Veterinary surgeons need to be resourceful and able to direct inexperienced assistants while occupied with surgical problems, and adapt themselves to varying and oft times trying situations without sacrificing fundamental principles of good surgery.

Contents of this book are divided into eight chapters. Chapters 1 and 2 are concerned with wound healing and presurgical considerations including antiseptics and disinfectants, sterilization of instruments, asepsis, chemotherapeutic aids, anesthesia, shock, fluoroscopy and radiology, and postoperative care of patients. The remaining chapter deals specifically with surgical procedures commonly performed on various species of domestic animals including pet animals. This portion, in particular, has been enlarged since the previous edition (1951) by 54 pages consisting largely of material of special interest for students. In fact, the author has slanted discussions generally for advanced veterinary students. This does not, however, detract from its value as a review and guide for practitioners.

Publishing costs have been kept to a minimum by retaining the size (8" x 11") originally employed for this material. Printing is by lithographing process on uncoated paper stock. Halftone illustrations are, nevertheless, clear and detailed.

ITEMS OF VETERINARY INTEREST

No effective treatment is known for 40 important parasites of cattle.

▼

It is estimated that 5,000,000 cows were inseminated artificially during 1953.

▼

Infertility is the principal manifestation of bovine vibriosis. It is readily transmitted by coitus.

▼

Synthetic vitamin A now used extensively in human medicine is beginning to compete with fish oils for use in feed mixtures.

▼

The Senate Committee approved $873,500. for brucellosis indemnity. The House had previously authorized up to $1,000,000.

▼

Cross-compliance and total acreage control of crops now in surplus are the most drastic controls ever imposed on American farmers.

▼

Iowa turkey producers raised 3,673,000 birds in 1953, and indications are that the 1954 crop will be even larger. Total cash receipts for these birds in 1953 were over $22,000,000.

▼

Three premises in Maine are now under three-year state quarantine for scrapie. Inspections will be made in the vicinity at six-month intervals.

▼

Recent new ruling by the F. F. D. A. allows for marketing broilers at any time after treatment with terramycin for the control of chronic respiratory disease. Previously, growers were required to hold birds beyond normal market weight and age.

▼

Poultry Inspection

Some 425 inspectors working in 250 poultry processing and canning plants are engaged in permissive inspection of poultry for wholesomeness. In 1953 this service inspected approximately 1,000,000,000 lb. of poultry. Inspection service is rendered on a voluntary basis, and is claimed to be practically self supporting.

Half the meat produced in the world is beef and veal, four-tenths is pork, less than one-tenth is mutton, and the rest is goat and horse meat. *S. N. L.*, July 10, 1954.

▼ ▼ ▼

Anthrax

(Continued from page 400)

was isolated from two samples of bone and from one of sacking.

Enactment of regulations by the U. S. Department of Agriculture should prevent anthrax outbreaks that may be caused by bone or bone products in animals or man. These require: (1) All bone meal used for fertilizers and feed must be heated to 250 F. for one hour under 20 lb. of steam, (2) all raw bones imported must be brought in under bond and processed under the supervision of the U. S. Department of Agriculture; sacks in which they are imported shall be burned or sterilized. The only bones that can be brought in without special processing are trophies or clean skeletons destined for museums and similar institutions.

Now Sixth Revised 1954 Edition of

THE PRACTICE OF VETERINARY MEDICINE

One hundred sixteen illustrations
811 pages, 6x9

By D. H. Udall

Professor of Veterinary Medicine and Superintendent of the Ambulatory Clinic, Emeritus

in the

NEW YORK STATE VETERINARY COLLEGE AT CORNELL UNIVERSITY

UDALL PUBLISHING COMPANY
106 BRANDON PLACE
ITHACA, NEW YORK

POSTPAID PRICE $8.50